TRADITIONAL METHODS APLIED IN THE PROJECT PROCES VERSUS USING BUILDING INFORMATION MODELING (CAD VS BIM)

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Approval sheet of the Thesis

This is to certify that we have read this thesis entitled **"A community center project at the new boulevard of Tirana"** and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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ABSTRACT

TRADITIONAL METHODS APLIED IN THE PROJECT PROCES VERSUS USING BUILDING INFORMATION MODELING

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Building Information Model or what we call BIM has spread in popularity in the architecture, engineering, and construction industries. Nowadays, BIM is the most promising development in the AEC industries.

What is BIM and how does this platform help in the AEC industries?

BIM (Building Information Modeling) is a tool that represents the process of development of the planning, design, and construction part of a project. It helps architects, designers and constructors to better understand how their final product will materialize along the way identify and even better minimize the operational problems.

The aim of AEC is to achieve better building projects by increasing productivity and quality while at the same time reducing delivery time. In this case, BIM is the program toll that has all the potential to achieve these objectives.

In this paper, the knowledge of BIM, the benefits and challenges for the construction industries are discussed. First presented is the main concept of BIM and the possible application in different projects. Then, the role of BIM and its benefits in comparison with the most usable and basic tool, AutoCAD. In the hope of achieving a better comparison, the Stanford University study is taken into consideration by analyzing all the data gathered and collection of BIM and CAD at the same time. After that three case studies are presented to better illustrate the application of BIM in the project and its importance in achieving more productivity and reducing the delivery time.

It is followed by an actual project done in Kavaja city by ‘Taulant SHPK’ company referring to its process done in CAD and then comparing it and analyzing it in BIM (Building Information Modeling) tools. The research aims to study the changes in the project when implementing BIM, its importance and how does the project manager's role change in relation to the actors.

Keywords: *BIM (Building Information Modeling), BIM Software, AutoCAD, Project Role Manager, Delivery time, Productivity, AEC (Architect, Engineering, Construction)*

ABSTRAKT

APLIKIMI I PERDORIMIT TE BIM NE PROCES DHE KRAHASIMI I TIJ KUNDREJT MENYRES TRADICIONALE

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Modeli i Informacionit të Ndërtimit, ose çfarë ne e quajmë BIM ka përhapur vëmendjen në industrinë e arkitekturës, inxhinierisë dhe ndërtimit. Në ditët e sotme, BIM është zhvillimi më premtues në industritë e AEC.

Çfarë është BIM dhe si ndihmon kjo platformë në industritë AEC?

BIM (Modelimi i Informacionit të Ndërtesës)është një mjet që përfaqëson procesin e zhvillimit të pjesës së planifikimit, projektimit dhe ndërtimit të një projekti. Ndihmon arkitektin, projektuesin dhe konstruktorin për të kuptuar më mirë se si do të jetë produkti I tyre përfundimtar gjatë rrugës së tyre dhe për të identifikuar dhe minimizuar edhe më mire problemet operacionale. Siç e dimë me siguri, qëllimi i AEC është të arrijë një projekt më të mire ndërtimi duke rritur produktivitetin dhe cilësinë dhe në të njëjtën kohë duke shkurtuar kohën e dorëzimit. Në këtë rast, BIM është program që ka të gjithë potencialin për të arritur këto objektiva.

Në këtë punim, diskutohet njohuria e BIM, përfitimet dhe sfidat për industritë e ndërtimit. Së pari është paraqitur koncepti kryesori BIM duke përfshirë shpjegimin e programit BIM dhe aplikimin e mundshëm në ndërtim.Pastaj,roli i BIM dhe përfitimet e tij në krahasim me mjetin më të përdorshëm dhe themelor Auto Cad. Në ndihmë të arritjes së një krahasimi më të mirë,studimi i Universitetit Stanford merret në konsideratë duke analizuar të gjithë mbledhjen e të dhënave dhe procesin e BIM dhe CAD në të njëjtën kohë.

Pas kësaj, paraqiten tre raste studimore për të ilustruar më mire zbatimin e BIM në projekt dhe rëndësinë e tij në arritjen e më shumë produktivitetit dhe zvogëlimin e kohës së dorëzimit. Ky kërkim synon të studiojë ndryshimet në projekt kur zbaton BIM, rëndësinë e tij dhe se si ndryshon roli i projektit të menaxherit në lidhje me aktorët e tjerë.

Fjalë kyçe: *BIM (Modelimi i Informacionit të Ndërtesës), Softueri BIM, AutoCAD, Menaxheri i Rolit të Projektit, Koha e Dorëzimit, Produktiviteti, AEC (Arkitekt, Inxhinieri, Ndërtim)*

DEDICATION

To my family!

To my father who made me fall in love with education.
To my mother who was always ready to lend a helping hand with my architectural studies and to my sister for the late nights making sure I was giving my best.

Thanks to God, Family and Myself

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My grateful acknowledgements go to MSc. Teuta Kodra for her dedication, guidance and the availability through this research. I am grateful for the opportunity to study this interesting topic in our county.

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CHAPTER 1

INTRODUCTION

"The biggest enemy of the construction industry was the arrival of email. Two parties would make amendments to the drawings, but they wouldn't tell anyone else. With BIM, everyone can see what happened".[1]

More than thirty years ago, architects participating in the architectural design process were faced with a truly new scenario due to the new and increasingly expanding Information and Communication Technology (ICT)industry.

However, in their work, they have been unable to adopt the new technology. Compared to other sectors, the architecture-engineering-construction (AEC) industry is lagging behind when it comes to the effective application and use of ICTs. While facing with such occurrence new technologies have been improved. It is widely believed, that the 2d workflow of architects and engineers has not changed and merely been modernized to fit an expanding world that has quickly adopted computerization.[2] On the other hand, there is BIM which had to bring a culture change and facilities in the AEC industries. Still, BIM cannot compare with 3d modeling.

BIM (Building Information Modeling) is an intelligent model-based process that provides insight for creating and managing building projects faster, economically by reducing the cost of the project and at the same time alleviating environmental impact. It is a design tool that has many capabilities such as modeling and producing construction documents. The integration of these technologies is going to lead the AEC

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[1] [1]Ismail,Iftikhar,"IPD&BIM within the Construction Industry "University of Salford Manchester,2018

[2] [2]Gann(2000),."Building innovation-complex constructs in a changing world.":pp150-186

[3] [3]"BIM and Big Data for Construction Cost Management", (2019), Weisheng Lu, Chi Cheung Lai, and Tung Tse, Taylor & Francis

industries to new era including better communication, cooperation and final product design.

1.1 Problem Statement

"BIM was Causing Architect to practice in more collaborative ways with designers, contractors and fabricators."[3]The scope of this thesis is to answer four main questions. The questions clarify better the structure of this research and its final product:

1. What is BIM and why it is important to use it?
2. What are the changes in the process when implementing BIM?
3. How does the project role manager change in relation to other actors when BIM is implemented in a project?
4. Which are the benefits and challenges during a process by using BIM?

The research in this project helps to provide information gained from different network sources and company members possess knowledge about BIM, but still have not gone through it in practice. It helps to answer the question in a productive way for the audience and the design too. BIM is a tool that in a certain way it is known as a name but not as an efficient tool to be used. There are not many cases in Albania and it is important to first let others know about the importance of the BIM and the value of using it in current project.

This research gives information on how a company has been doing their projects in alternative programs rather than BIM and continues to do so, due to lack of information on BIM both in theory and in practice. By analyzing the following case studies and bringing to attention the benefits of using BIM and how a project can be completed it will lead to a better awareness and a better decision in the use of the tools in terms of the project process.

[3] Ismail, Iftikhar, "IPD & BIM within the Construction Industry" University of Salford Manchester, 2018

1.2 Thesis Objectives

In this research there are three main points, each with a unique aim. The points are to share information about BIM, the process of creating a project by using BIM and the benefits and challenges of BIM. The aim of the BIM knowledge is to give all the information needed about its performance and importance in AEC industries especially and in our country. Without leaving behind the most important phase of its which is the project showing how BIM works and revealing the benefits and challenges along the way. All these phases will help in making BIM easier as a tool and important to be used.

1.3 Thesis Objectives

As mentioned above the aim of the research is to give a brief overview of BIM and then analyzing each part of it from the importance of it and to the way of its implementation. Firstly, the definition of BIM is given by providing some examples and then focusing more on the process of achieving it. A study from Stanford University is taken into consideration. The aim is to certainly let others know of BIM benefits and why it should be used. The university reached out too many AEC companies by providing insights into BIM as a solution, showing how it can be incorporated to their workflow leading to reduced overhead, time spent on projects, less mistakes along with a plethora of other benefits. To provide more information on how BIM tool works three case studies are taken into consideration. The first two case study which show in practice the implementation of BIM by the companies and in the same time studying its benefits and challenges that the companies have gone through. Another case study is included in the research paper in order to get more detail about the BIM process. The project is currently under construction. The company has initiated the project by using a program rather than BIM. There is a reason why this project is taken into consideration, to compare their project versus the same project done in the BIM tool. All the data gathering of the project done from the company is

based on all the information given by the company. In addition, there is a questionnaire done to the workers about the project and the tools of doing it. Then the same project is done by using BIM tools. In this way it will be more effective even for the reader to better understand the way how BIM works. By analyzing the following case studies and bringing to attention the benefits of using BIM and how a project can be completed it.

CHAPTER 2

LITERATURE REVIEW AND CASE STUDIES

2.1 BIM in theory and practice

Building Information Modeling is a process supported by various tools, technologies and contracts involving the generation and management of digital representation of physical and functional characteristics of places. BIM simulates the construction project in a virtual environment.

The resulting model building information is a data-rich, object-oriented, intelligent and parametric digital representation of the facility from which views and data appropriate to various users can be analyzed to generate information and can be used to improve the process.[4]

BIM has become one of the most important advancements in construction projects. The technical advancement of BIM has been making steady progress. However, it is very important to be aware and very careful with the way BIM is implemented in the project. It is crucial to understand how BIM works, its importance, its implementation and how it interacts within the ecosystem of the project, doing so will help the project achieve the highest performance. When BIM is implemented in the project, it can provide many benefits.

The value of BIM has been illustrated very well by the project results. It can increase design quality, greater prefabrication due to predictable conditions, improved field by visualizing the construction schedule and many more. [5]

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[4] Associated General Contractors of America. (2005). The Contractor's Guide to BIM, AGC Research Foundation, Las Vegas,

[5] Better buildings through digital practice: Changes in roles and processes", (2011), T.U. Delft University of Technology.

However, there are even cases when BIM has not been implemented in a very effective way into the project leading to increased cost for the modeling services, schedule delays due to missing information and so on. This has happened not because of the BIM program itself but because the team didn't know how to proceed with the BIM plan. BIM requires detailed planning and process modification for the project team members to achieve the information from the actual model information. It is a hard process to go from visualization to implementation and requires preparation and an organized approach.

Each process has its own way of organization which leads to a successful project even though the conditions are different from each other.

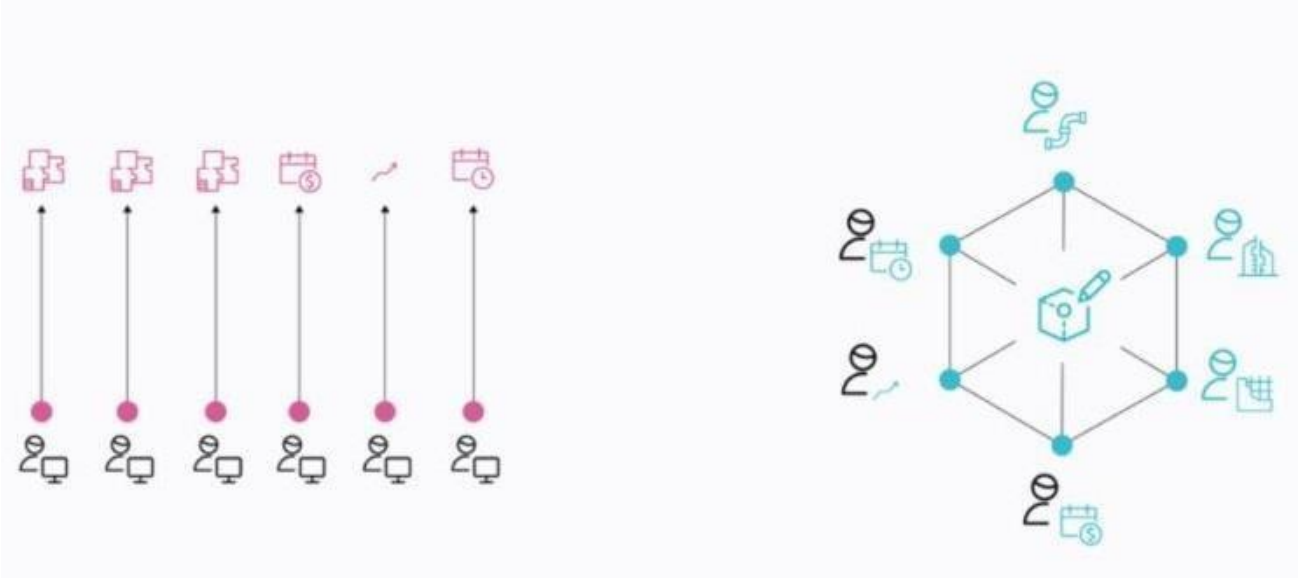

Figure 1: Sequential CAD Process Collaborative BIM Process

The most common way of starting and evaluating a project is by using CAD.

CAD is a platform program that describes a building by independent 2D videos such as sections and elevations. Editing one of the views requires that all other views must be checked and updated. Furthermore, 2D drawings are graphical entities only such as lines, arche sand circles. [6]On the other side, there is BIM where the start of the project is different from CAD. The process starts by creating the 3D model and then ending up by having all the planned sections, 2D view of the project. In BIM objects are defined in terms of building elements and system such as spaces, walls, beam and

columns.[6]

According to a Stanford University Study, BIM was a highly efficient tool and very productive to the ones that used it for their project. Stanford University reached out too many AEC companies and asking how BIM was implemented in their project, its importance and its benefits during the project process. After all the calculations, they come up with the conclusion in the figure below.

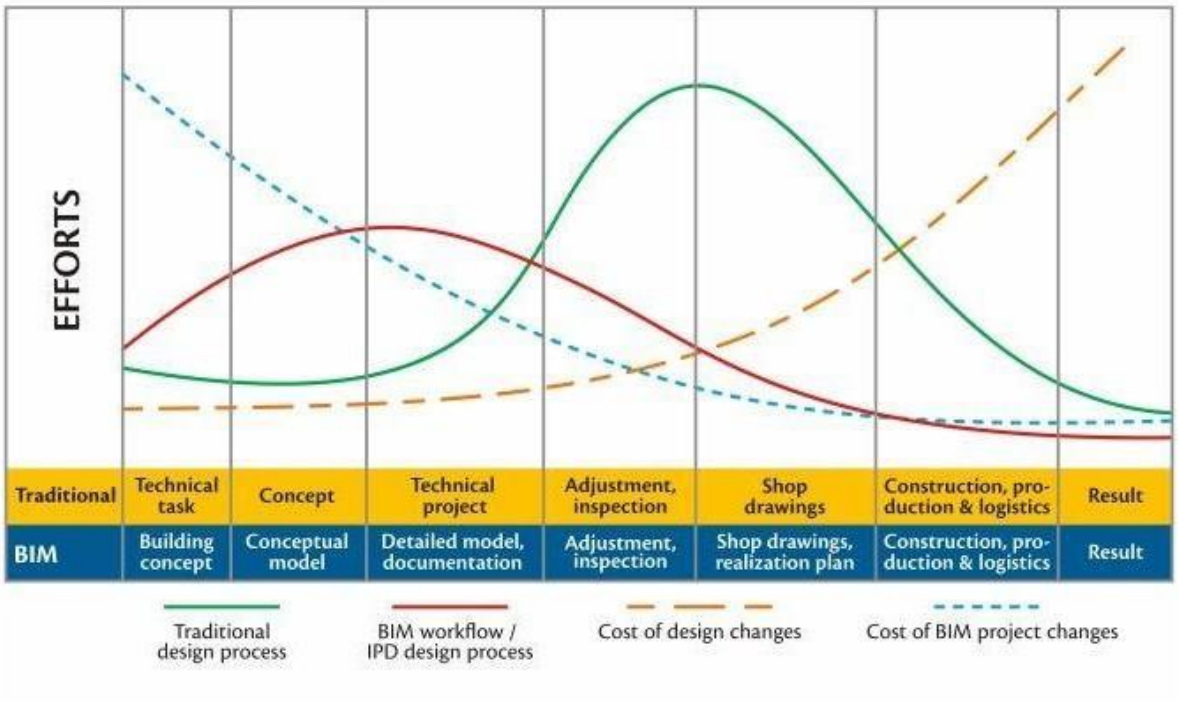

Figure 2: Traditional vs BIM

Stanford University reached out too many AEC companies and asking how BIM was implemented in their project, its importance and its benefits during the project process. After all the calculations, they come up with the conclusion in the figure below.

The above graphic shows the result of the calculations of the Stanford Study according to project that has been done by using BIM and by using other platforms

[6] Building Information Modeling (BIM): Benefits, Risks and Challenges",Mc Whorter School of Building Science, Auburn
University, Alabama
[7] "Bim for Govies' (2013), DLT Solutions, LLC, Herndon, Virginia.
8."Building Information Modelling for Project Managers', (2017

instead of it.

The study has time, project deadline and the budget. Despite the other benefits of using BIM it is also good to note there were cases that the project not only delivered in time but even before that. This is what they called the “breakdown point”.

Stanford University center based on 32 major project BIM indicates benefit such as:

1. Up to 40% elimination of unbudgeted change
2. Cost estimation reduction within 3%
3. Up to 80% reduction in time taken to generate accost estimate
4. A savings of up to 10%of the contract value through clash detections.
5. Up to 7% reduction in project time

2.2 SWOT BIM Analysis

Currently building information modeling or BIM is having a disrupting impact on the AEC industries. It constitutes the fastest growing approach in the field of construction management. It is slowly altering the landscape of the construction industry.

Referring to BIM, it is not only important to obtain information. Above all it is important to simplify information of the model and use the information contained in the model in both geometric and sematic ways during the whole process of the development of a project.

As with any tool or program that has been created and used within the AEC, BIM which is a unique tool, does have downsides and blind spots in its execution. It is imperative for a user such as an architect or engineer to not only understand the benefits of a specific program but also be very aware of where the program is lacking, in this case BIM.

The following analysis will show the advantages and disadvantages of using

BIM and will be following the SWOT analysis model. SWOT analysis provides a simple but powerful framework in characterizing and measuring all the aspects of the process by using BIM so all end users can understand the benefits and blind spots of BIM.

An established architect or engineer (end user) can perform at their best when they are fully aware of all the pitfalls that the program offers.

The intention of the SWOT analysis is to uncover the possibilities that BIM technology can provide, this is paired against a risk assessment of the same technology. This compares the strengths and weaknesses of projects that have used BIM.

The United States national institute of building sciences or NIBS states “A BIM is a digital representation of physical and functional characteristics of a facility. As such, it servs as a shared knowledge resource for information about a facility forming a reliable basis for decision during its lifecycle from inception onward.”

The overall purpose of using BIM is to reinforce the building process end to end including the geometry as well as including information on individual elements that provides a more robust description. This allows the construction industry to save money, improve construction speed and streamline the whole process.

BIM provides large improvement over previous construction practices by allowing the amalgamation of data information and geometric presentation of the structure into one place. It allows the collection of data through the design phase of construction which helps identify possible clashes and interdependencies. With the improved layout and visual of the structure being built, clashes in the construction will be identified faster and provide information on the site that improves intercompany communication.

The streamlined process of BIM allows the ability to check the geometry and individual information of the model efficiently. This agile work environment allows ease of access to your work, which previously would require time consuming redrafts during the beginning stages of the project, can now be accessed and fixed before the execution stage of work.

Strength

The flow of information and its ability to provide information in easy to read format that can be manipulated in a three-dimensional space allows the possibility to create documents in higher quality. This helps with “Clash Detection” that can spot early mistakes made in the 3d model, saving time and money that can bog down projects.

Reduction of construction cost

By having access to all the information needed from the model it gives you the possibility to gather information in one place and being seen by all the participants improving the information flow process and clash detection and, in this way, BIM allows to reduce the cost of the entire investment. According to the report of NIBS, the greatest savings are generated in the architectural design stage where 55 % declared that BIM reduced the cost of this process. According to these analyses, it can be said that BIM has a lot of positive impact on the reduction of the cost starting from the design stage of the model until its finished one.

Reduction of construction material waste

With the improved clash detection and better models that catch mistakes before the construction phase BIM allows a better procurement of materials. This helps reduce overall cost by allowing bulk purchasing and reduces waste of unused material. Beyond bulk purchasing of much needed materials it allows the ability to accurately purchase smaller batch orders and set a malleable delivery schedule further reducing the environmental impact.

Automation of the drawing process

The process of generating the drawings is agile and cross platform. When any changes are made during the process they are shared across all other sheets of the model. This includes the three-dimensional view. It also allows for very precise changes to models without having to change the whole model. Therefore, time is saved in labor while refining the model over older methods of redrawing models.

Weakness

If the models change between programs, which they often can, especially during a long project, data loss becomes a large issue as not all programs are set up to take in all information that the BIM model provides. These losses usually happen when the project is exported to a 3rd party program using a different layout, such as 2d and 3d CAD. This is especially seen when information is being transferred between contractors and subcontractors who may not have all the same programs to view models.

High implementation cost of BIM in company. The large strain of BIM files, due to the large amount of information, and the need for high end hardware to support the programs. BIM programs tend to be cost prohibitive compared to CAD or traditional methods of modelling construction. This creates a large upfront cost to companies deciding to use the BIM method.

Opportunities

Student education about BIM**.** BIM technology is slowly working itself into higher education, there are now post-graduate degrees offered in BIM. This will trickle down into young trained professionals filling the ranks of these construction companies.

Threats

Lack of qualified and experienced staff. As with all new technology adoption seems to be slow especially for established architects and engineers. This creates a gap between companies wanting to use and hire BIM trained professionals and the current work market. But as stated above courses are currently being introduced into post-secondary schools.

Unwillingness of the users/client to use BIM. Again, the slow adoption of technology is a large hurdle, but it seems to be more of a lack of knowledge of the benefits of BIM. Some may see this model as a novelty or a passing fad, this can further

cement the unwillingness to adopt the BIM model. This creates a gap between companies wanting to use and hire BIM trained professionals and the current work market. But as stated above courses are currently being introduced into post-secondary schools.

2.3 BIM in conceptual design phase

The conceptual design phase of the project is part of the overall process, ending with the finished models of the project. It is possible that during the conceptual phase that hand drawings and sketches are still created, mostly to explore all different alternatives and allowing for ease of evaluating the design without having to implement 3d models. On the other hand, there is the present of cad software which is more effective than traditional drafting methods because of the ease of use. 2d CAD can slow down the creative process during the early design phases, because of the need to be able to visualize the project without worry about how all parts interact. The first phase sets the building orientation and structural shape, with interior flourishes. At this phase the granularity of 3d and 2d models are not needed.

Foque (2010) expresses that: 'Intuitive thinking and rational thinking are not components; they are the twins' poles between which the artist structures reality.

The transition from the early conceptual design phase to the early stages of architectural design it is important to take advantage of the BIM model. In this case there seems to be a middle ground between conceptual phase and architectural phase which can be seen as a digital preliminary design phase. This phase can take full advantage of the BIM process by taking the concept design and finding if there are any flaws in its design, and allows analysis feedback.

BIM technology creates an avenue for designers to explore and create a more streamlined design phase, allowing a better understanding of the different possibilities in architectural designs leading to better constructed buildings.

The following paragraph will cover what BIM tools can offer in the design process by reviewing a case study to better highlight the benefits of using BIM in the

early conceptual phases leading to a reduction of cost and waste.

Georgia Tech developed the following case study, which asks different firms and companies to perform at minimum 3 different spatial concepts in the traditional way, so that the team could compare them on space programmed, standard and energy expended. As a comparison the same spatial concepts were done in BIM technology. The below model describes several assessments that can be achieved from a single conceptual model.

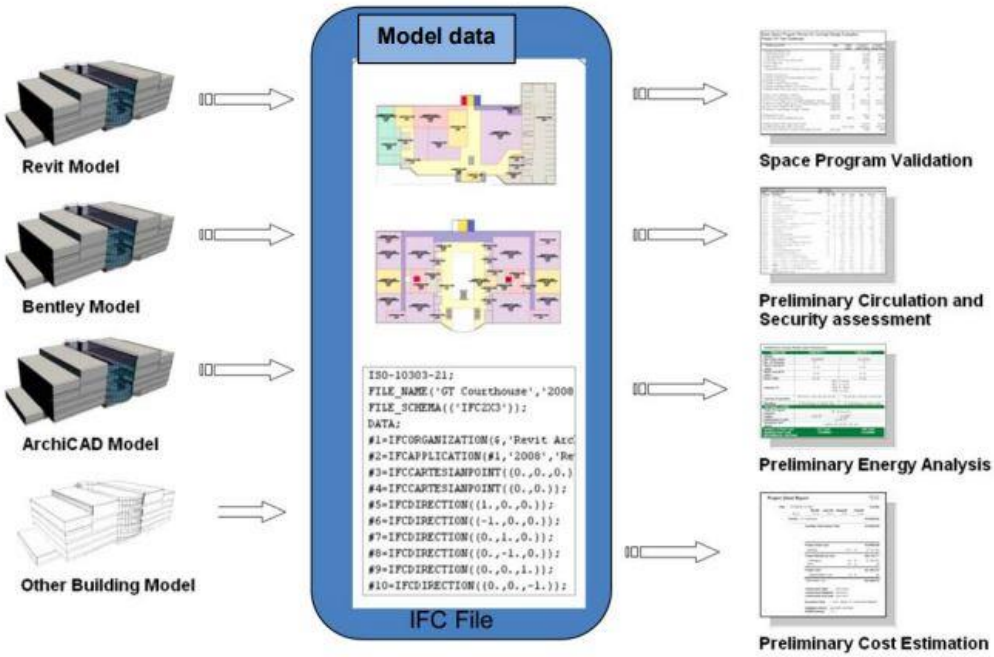

Figure 3: Assessments that can be provide by a single conceptual model

BIM benefits based in the case study at this particular stage of design can be categorized as:

Accurate visualization

The advantages of 3d representation which let the design team known and understand the design and the problems better (RAIC 2007). In this way it provides the geometrical representation of the building's components in a database.

Design optimization

By the implementation of BIM design errors and mistake are reduced and a few changes are needed in the later stages of design. It gives you the possibility to have in control the design by trying different way of creating the conceptual design.

Design coordination

A building information design model provides an integrated database of the building in a way of sharing among the team members easily and able to be improved. BIM facilities communication between designers assuring them that there will be no clashes or errors in later stages (The foundation,2009).

Cost Estimation

All the geometric information is already available in the early stage of the process design. Model, accurate and estimation can be provided which leads to feedback on design.

According to all the information above and the case study taken in consideration still some people would believe that concept design stag is more creative and don't need any other integration with the further phases of design. However, it is exactly this stage that the building and its cost are being shaped and such information would need to begin from the first stage (Autodesk2007). If we want to use both to achieve more freedom in creative design and more information detailed in BIM the importing and exporting will take a lot of time and for the more a lot of clashes and errs will appears. (Eastman 2011)

Even if we assume that no lose data would be part of the process if an unexpected change happens it will immediately effect on the concept of the building. In such case time and money will be lost.It is important to be mention that BIM is a process not only a software to be used. And this process is changeable in the whole steps of the project.

Garrett Nelli said "Architects hold a unique position in society and we play various roles throughout the construction process. We see ourselves acting as

moderators, activists, public speakers, and leaders of many parties. "Our exposure to the public and our variety of different skills prepare us to better equip ourselves to be a key player in implementing this change in design thinking." (Margaret Mead, 2005)

Each developed country bears the responsibility of providing community facilities for the urban mass. Among the various facilities, the community center is one of the main civic facilities that aims to facilitate community interactions thus contributing to community development in urban areas. In this view, it is important to design for the health, safety, and well-being of the public. A recent increase in environmental standards and health thinking may be associated with public health. Various programs such as community activities and services, religious youth groups, andother community-based activities, play a major role in human life. What do we know about the role and processing programs of the community where we live? How can you ensure that the program is designed to successfully meet civic needs for a happy and productive life?

A city like Tirana, where the lack of spaces for community gathering and interaction is severe,present an urgent need in solving problems and increasing their potential to ensure effective and multi-purpose. This study reveals that community centers can be a center of community development, essential elements of well-being, and health protection. It provides opportunities for policy, practice, and research to ensure that the program is well designed to meet the needs ofyoung people.

CHAPTER 3

3.1 Case Studies

The reason of choosing these case studies is firstly because of the typology of each of them, quite the same with the Kavaja's project and for the more the programs that these companies have been used. All the case studies below show some cases where BIM tools are implemented, the reasons and benefits of using BIM.

3.2 Aquarium Hilton Garden Inn Georgia

The purpose of this case study is to illustrate the cost and time saving realized by using building information model. All the information is provided by Holder Construction Company.

Table 1: The project data

Project name	Hilton Aquarium, Atlanta, Georgia
Projects cope	$46M,484,000 SF hotel and parking structure
Delivery method	Construction manager at risk
Contract type	Guaranteed maximum price
Design assist	G Cand subcontractor son board at design definition phase
BIM scope	Design coordination, clash detection, and work sequencing
Filesharing	Navis works used as common platform
BIM cost to project	$90,000-0.2%ofproject budget($40,000paidbyowner)

Cost benefits	$600,000 attributed to elimination of clashes
Schedule benefit	1143 hours saved
Program Used	BIM Tools Program Revit / Navis Work

As shown in the table above, the aquarium Hilton Garden inn is a $46 million project consisting of the construction of a 484.000 square foot building. As a mixed-use development, itincludes14story,242 room hotels, a 700car parking space and 25000 square feet of retail space on the ground level of it. The schedule of the project ten clouding both the design and construction part of it, was 24 months.

Figure 4: The aquarium Hilton Garden

Holder construction used a three-person BIM team to create 2D CAD templates on two occasions; 50 percent concept documents and 100 percent construction

documents. The Filed BIM supervisor even used the project as soon as the construction of the project started to encourage the use of BIM on the project site.

The three-person BIM team at holder construction developed 3d models of the architectural, structural and MEP system of the proposed building design as shown in the figure below.

Figure 5: Automated Clash Detection

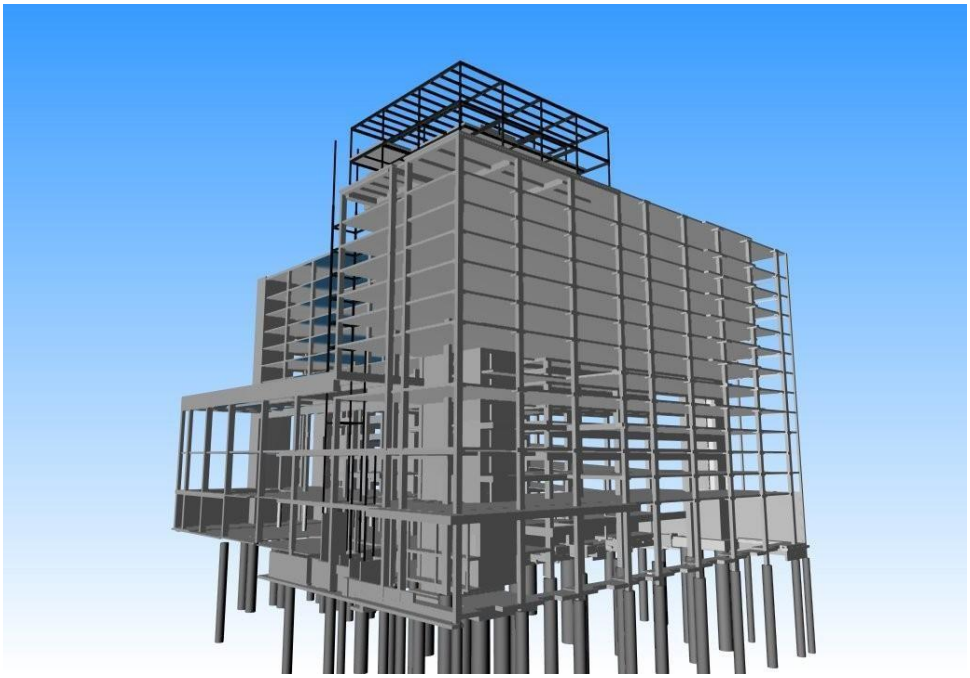

Figure 6: The structural model

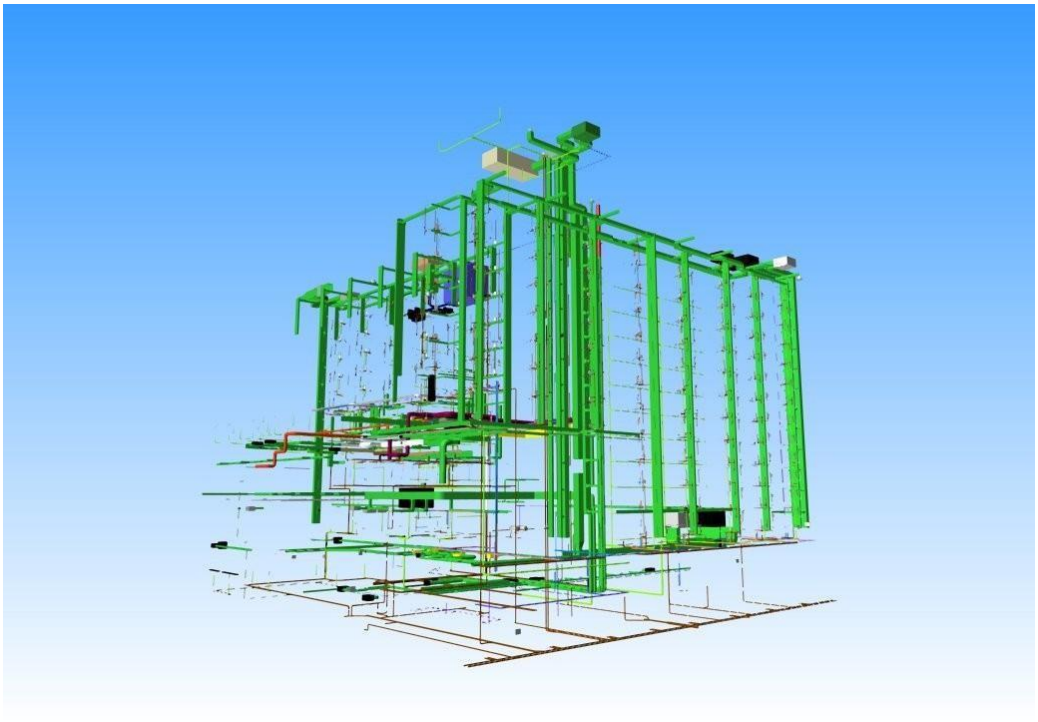

Figure 7: The MEP model

Figure 8: Composite architectural model

These models were used for scope verification, visualization and even clash detection. They firstly helped the owner envision the way of design and have a better clear image of how the building will look like and then identified design conflict, problems during the project and clash detection. After the three-person BIM team developed the three D model of the project, they began to detect clashes.

During the Design Development (DD) process, 55 collisions were found. Resolved collisions were tracked resulting in a loss of $124,500 being avoided. This stage alone created a return savings of $84,500 on the initial $40,000 BIM cost. During the Construction Documents (CD) process, the model was modified and the collisions resolved were tracked.

Every crucial clash was shared with the design team through a model viewer and a numbered collision log with a list of the individual photos of each collision by architectural or structural discipline. Over 590 clashes have been identified via the Navis Works program. The total cost savings, based on the 590 collisions observed during the program, is estimated at $800,000, offering a net return on the BIM budget of$760,000.

Collision Phase	Collisions	Estimated Cost Avoided	Estimated Crew Hours		Coordination Date
100% Design Development Conflicts	55	$124,500	NIC		*June 30, 2006*
Construction (MEP Collisions)					
Basement	41	$21,211	50	hrs	*March 28, 2007*
Level 1	51	$34,714	79	hrs	*April 3, 2007*
Level 2	49	$23,250	57	hrs	*April 3, 2007*
Level 3	72	$40,187	86	hrs	*April12, 2007*
Level 4	28	$35,276	68	hrs	*May 14, 2007*
Level 5	42	$43,351	88	hrs	*May 29, 2007*
Level 6	70	$57,735	112	hrs	*June 19, 2007*
Level 7	83	$78,898	162	hrs	*April 12, 2007*
Level 8	29	$37,397	74	hrs	*July 3, 2007*
Level 9	30	$37,397	74	hrs	*July 3, 2007*
Level 10	31	$33,546	67	hrs	*July 5, 2007*
Level 11	30	$45,144	75	hrs	*July 5, 2007*
Level 12	28	$36,589	72	hrs	*July 5, 2007*
Level 13	34	$38,557	77	hrs	*July 13, 2007*
Level 14	1	$484	1	hrs	*July 13, 2007*
Level 15	1	$484	1	hrs	*July 13, 2007*
Subtotal Construction Labor	590	$564,220	1143	hrs	
20% MEP Material Value		$112,844			
Subtotal Cost Avoidance		**$801,565**			
Deduct 75% assumed resolved via conventional methods		($601,173)			
Net Adjusted Direct Cost Avoidance		**$200,392**			

Figure 9: Cost and time saving via BIM in Hilton Aquarium Project

The Aquarium Hilton Garden Inn project has proven to be a great example of the advantages that Constructing Knowledge Modeling can add to the project. This project realized some great benefits by using BIM and at the same time exceeded the expectations of the owner and the other project team members.

3.3 Case study two

One Island East, Hong Kong

Table 2: The project data of One Island east, Hong Kong, China

Project name	One Island East, Hong Kong, China
Projects cope	$300M,1,517,711 SF commercial building

Structure	Reinforced concrete
Exterior	Aluminum curtain wall
Owner	Swire Properties Limited
Contractor	Gammon Construction Limited
BIMs cope	Design coordination, clash detection, and works sequencing
Program Used	BIM Tools Program Revit / Navis Work

This case study documents the application of BIM to handle the functional and financial relationship between the design, development and facilities management of a large, complex project by the owner-developer. The owner recognized the ability of BIM to handle knowledge more effectively and to save time and expense over the duration of the project.

The skyscraper is a commercial office building, rising 298.35m (979 ft) and has 69 stories plus two levels of basement. There is a sky lobby on the37th and38thfloors. All the process was done in BIM tools which gave the company the possibility to work faster and easier by ending it in time and crating such a great structure.

Figure 10: One Island East, Hong Kong

Figure 11: One Island East, Hong Kong

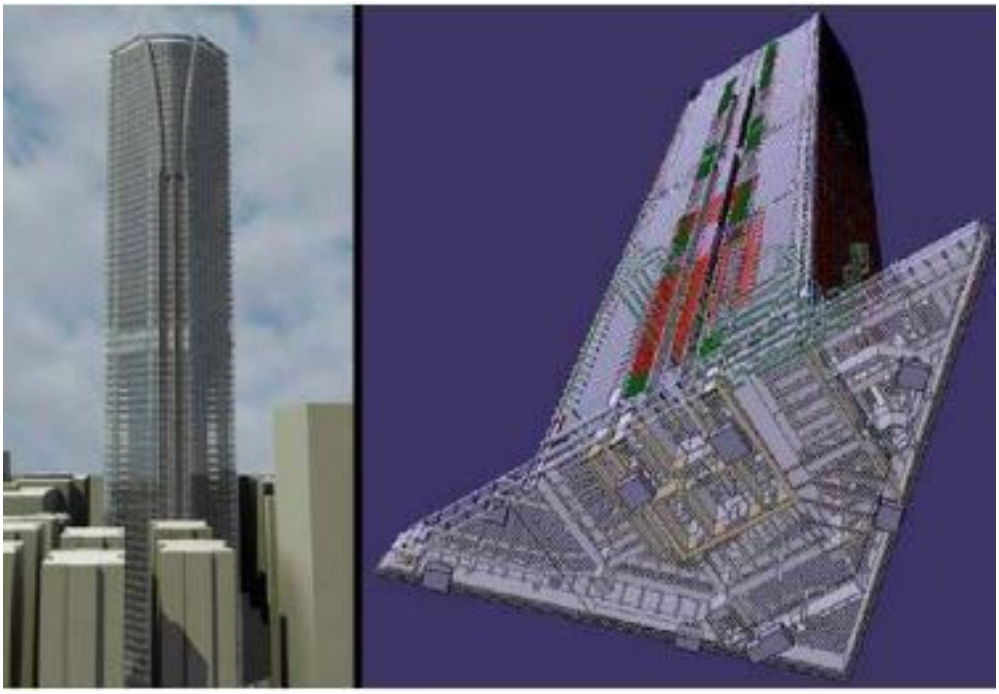

Figure 12: Building information model

The figure shows building information model of this facility. Almost all team work problems have been handled by BIM. As seen in Figure 11, over 2000 clashes and errors were found prior to building and development, which indicates that major cost reductions were obtained relative to imperfect design details inherent in conventional 2D design.

Figure 13: One Island East, Hong Kong

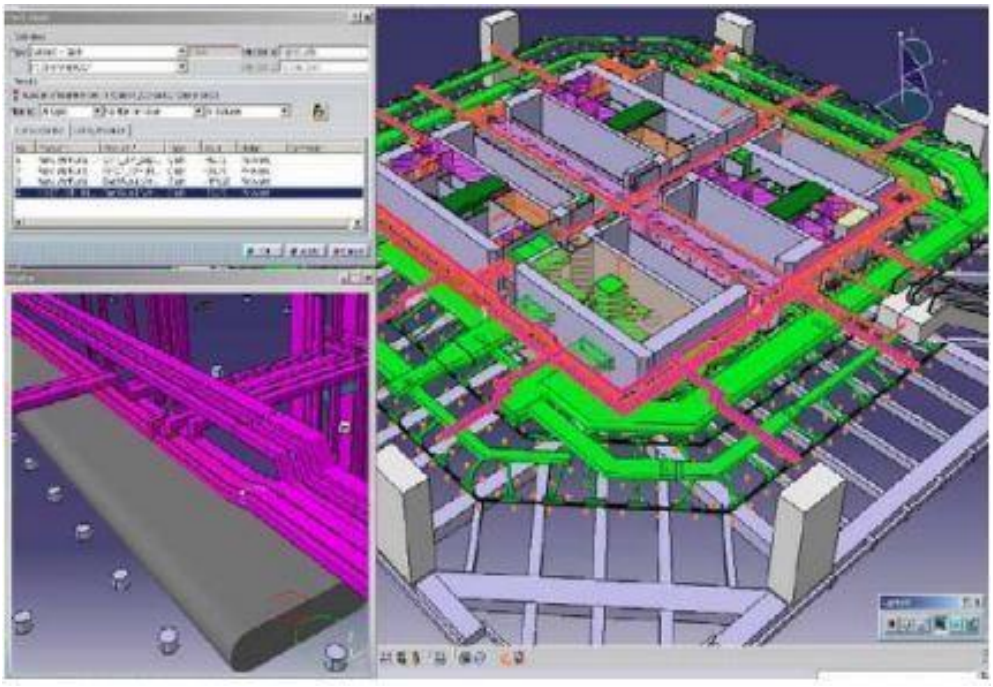

Figure 14: Automated clash detections

As shown in the figure 11, 2000 clashes and errors were identified in the construction, which mean that cost saving was achieved compared to the incomplete design information in a traditional 2d process.

BIM provided an uptick in performance over traditional 2d methods for the project. It achieves a 24 month ahead project schedule as well as a 20 % saving of construction cost (that means 19.9 M). For the more as mention above the rewire 150 clash detection per week and 254 m3 materials to be saved.

Figure 16: Interactive Coordination Process: Virtual Building Team Walked

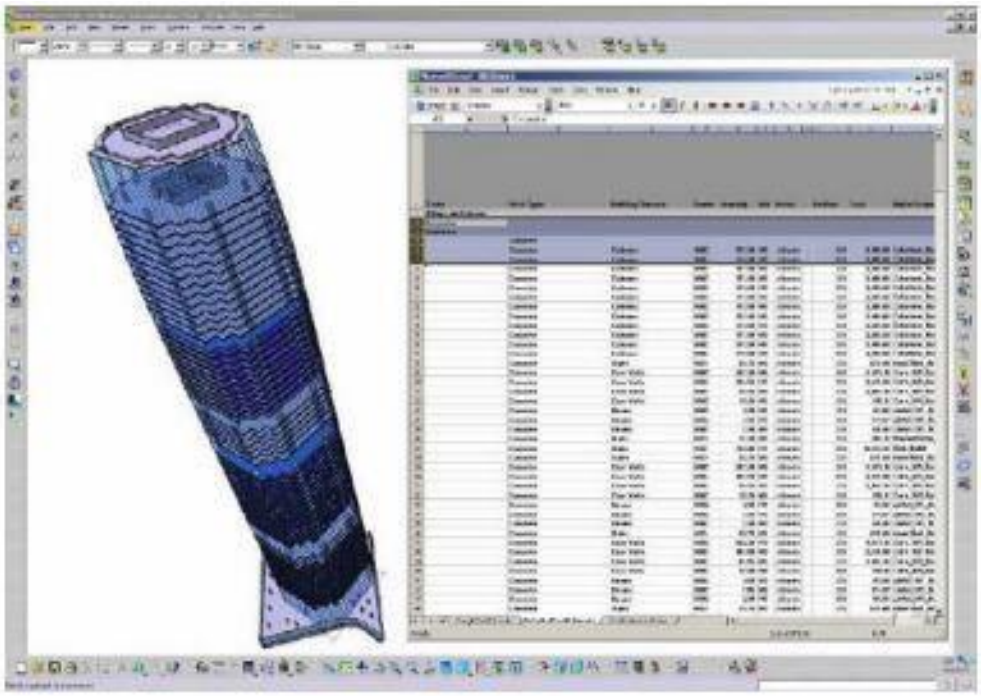

Figure 15: Preparation of Automated Estimates (Gammon Construction Ltd, HK)

3.4 Case study 3

Kathleen Kilgour Centre

Innovative design and operation through BIM. The project The Kathleen Kilgour Centre is new clinic at Tauranga Hospital. Procured by the Bay of Plenty DHB under a Public Private Partnership (PPP), it is setting New Zealand project management and design precedents through its use of Building Information Modelling (BIM) processes and technologies, combined with integrated project delivery methods. The building's design and construction have been coordinated with virtual models and also using BIM in its operation maintenance and management.

The healthcare facility is 3,000m2 and houses 3 treatment spaces. This as well as support clinical and spaces for administration. This whole area is spread over 3 levels. The innovation can be seen across its construction methods as well as expensive medical equipment.

The overall design ideas of the project were to provide a quality environment for inpatient services as well as any and all staff who work there. The building is also part of how the treat patients, it is an integral part to provide a stress-free environment. This is achieved through a building that does not feel like you are in a clinic but rather as a blend in with the natural surroundings and buildings which was able to be achieved through virtual models.

"The Kathleen Kilgour Centre is an innovative center of excellence. Its planning, construction, form and services all contribute to the better treatment of cancer patients at their most vulnerable time." Mark Fraunhofer, Kathleen Kilgour Centre General Manager.

Table 3: The project data of Kathleen Kilgour Centre

Project manager	The Building Intelligence Group
Architecture and interior design	Wingate + Farquhar, Assemble

Structural engineering	Redco
Services engineering	Inner scape
Program Used	BIM Tools Program Revit / Navis Work

The project has taken approximately two years and is due for completion in December 2014.

BIM use in project

The BIM usefulness within the project was easy to see. It provided greater and easier design phases as well as less rewrites and drafts during the construction phase.

BIM is used for:

1. Existing conditions modelling
2. Design authoring
3. Design review
4. Engineering analysis
5. 3D co-ordination
6. Digital fabrication
7. Record modelling
8. Facilities/asset management

The process of the project using BIM

The BIM process was implemented with the goal of being a collaborative experience for this project, it helped provide an excellent avenue of communication and information which helped the flow of information between client and partners. Early on the BIM execution plan was created by a team excelling at architectural design and was put in charge of BIM deliverables. Their creations were shared with all involved with the program including stakeholders. This helped build trust and was

used to create a clear and concise way forward.

Revit software was used to design all 3D models as well as architectural and interior service models. The 3D models were combined with traditional models and was analyzed for clash detection. Being able to connect over web-based programs with team members and update the model in real time helped all the fine tuning. Presenting in a 3D environment instead of a 2D environment helped build a visual layout and scope of the project.

Challenges and constraints

The building while not being a large-scale project still has many complexities. The importance of interconnectedness to the project was crucial to meeting design requirements. This was not limited to the configuration of work spaces, patient care areas and placement of high value medical equipment. The biggest challenge as lack of object libraries, requiring input from more than 50 consultants. The lack of using the BIM technique limited the project from using construction scheduling as well as cost estimation. The Kathleen Kilgour Centre needed to be built within a tight timeframe. This was achieved with collaborative and integrated project delivery methods enabled by BIM.

Results and benefits

BIM has underpinned an innovative approach to the design, construction and operation of the Kathleen Kilgour Centre. BIM as with all technologies when implemented correctly reduced any risks of the project. Because of these clashes rewrites and redraws were fewer and father in between than with a traditional method of construction. Better sharing of information also can be attributed to the use of BIM. The biggest benefit of BIM from a non-architectural stand point is the high visualization you can gain from this allowing those not used to architectural drawings to be able to visualize the final product. Because of this better visualization other parts of the team can provide critical feedback that makes sense within the confines of the design. Overall all of this helps to reduce costly redraws and industrial waste.

All designs used by Kathleen Kilgour Center will be uploaded and provided for

further use. This will help with creating design, fabrication, construction and asset data providing a large database for easy access. YouBIM will be this central database for instant access. If anything is broken or damaged the database can provide the correct specifications through an easy to access database. This will eliminate the need for measuring and readjustment of parts.

Over the course of its life the potential savings the YouBIM database can provide are vast. YouBIM was used firstly on this project and hopes to further expand helping with savings across the board. Cost total of the project was 35 million dollars. This versus the cost estimate of a traditionally designed building was around the same but because of the use of BIM provided a better tested and built structure.

Figure 17: Photo of the building: 'The Kathleen Kilgour Centre

CHAPTER 4

METHODOLOGY

4.1 CAD / BIM

The explosion of powerful computers in recent years has meant that software for architecture and engineering construction process or AEC has grown. Before the use of computers 30-40% of the project budget would be wasted. Also, loss of information from one phase to the next could cause even more loss of money and time. The difficulty of sharing the project between all parties involved was also a huge issue.

It seems there is still a far way to go for improvement though and more data needs to be implemented to raise the efficiency of AEC. Research shows that 93% of building owners report project going over their intended due date and 85% greatly miss their allotted budget. Even with AEC being used at these companies these problems still exist. Companies see this a huge area for improvement, but are unwilling to invest into these technologies due to trained professionals being few and far between. Another large issue is if the company implements these design practices it can be ruined if a subcontractor does not have the technology or use the same methods.

CAD systems generate digital files, while older systems create plotted drawings. These files are primarily consisting of vectors, identifications and associated linotypes. The better the technology got the more advanced these CAD drawings became allowing for text to be added to the drawings. Now 3D modelling advanced definitions and complex surfacing has been added. As CAD systems became more intelligent and more users wanted to share data associated with a given design, the focus shifted from drawings and 3D images to the data itself.

BIM has the ability to provide multiple views of the building model whether that is in 3d or 2d. A building will be described by its content or its capabilities. The approach of describing its capabilities is preferred because you can define what you do with the model rather than just what it is made of.

Among a growing trend is the use of building information modeling or BIM, it

has been adopted by architects, engineers and contractors. This is making AEC projects and buildings more complex, forcing many companies to have to accept the use of more advanced technology to keep pace. BIM is an intelligent model-based process the allows for AEC workers to efficiently design and create infrastructure.

BIM creates a framework allowing the integration of technologies and process that provides efficiency to AEC operations. Above all else it helps with the automation process of construction, creation of documents and minimized the amount of changes need to be implemented. Overall it is a great method that helps AEX businesses to keep costs down and help organize the increasing complexity of construction projects.

BIM is a fundamentally different way of creating, using, and sharing building lifecycle data. The terms Building Information Model and Building Information Modeling are often used interchangeably, reflecting the term's growth to manage the expanding needs of the constituency.

1. The NBIMS Initiative categorizes the Building Information Model (BIM) three ways
2. As a product
3. As an IT-enabled, open standards–based deliverable, and a collaborative process
4. As a facility lifecycle management requirement.

The above categories create an industry info value chain, being the end goal of BIM. The enterprise level scope of BIM is the biggest focus for NBIMS, merging multiple BIM implementations and stakeholder communities. BIM can be defined as a technology that models and adds various process to produce analyze and build sustainable models. This is shown through:

The growing sentiment around sustainability and environmental impacts has opened a huge gate for reusable infrastructure. BIM allows for his by having less waste. This also proved government agencies and organization visual representations of buildings rather than old CAD drawings that can potential lead to confusion.

4.2 Structural Design with Traditional Method versus BIM Case Study

(Further information on the changes of the project process from CAD Version to BIM use) Case Study (1): Structural Design with Traditional Method versus BIM. A 2story building reinforced with concrete including a basement and pitched roof was created using two design methods. The time it took for the traditional method is calculated by employed software the time it takes to edit. Figure 15 illustrates the structural design model conversion phases starting from receiving the architectural designs to designing the statically system, digitization, meshing in AutoCAD and structural-analyzing in SAP2000

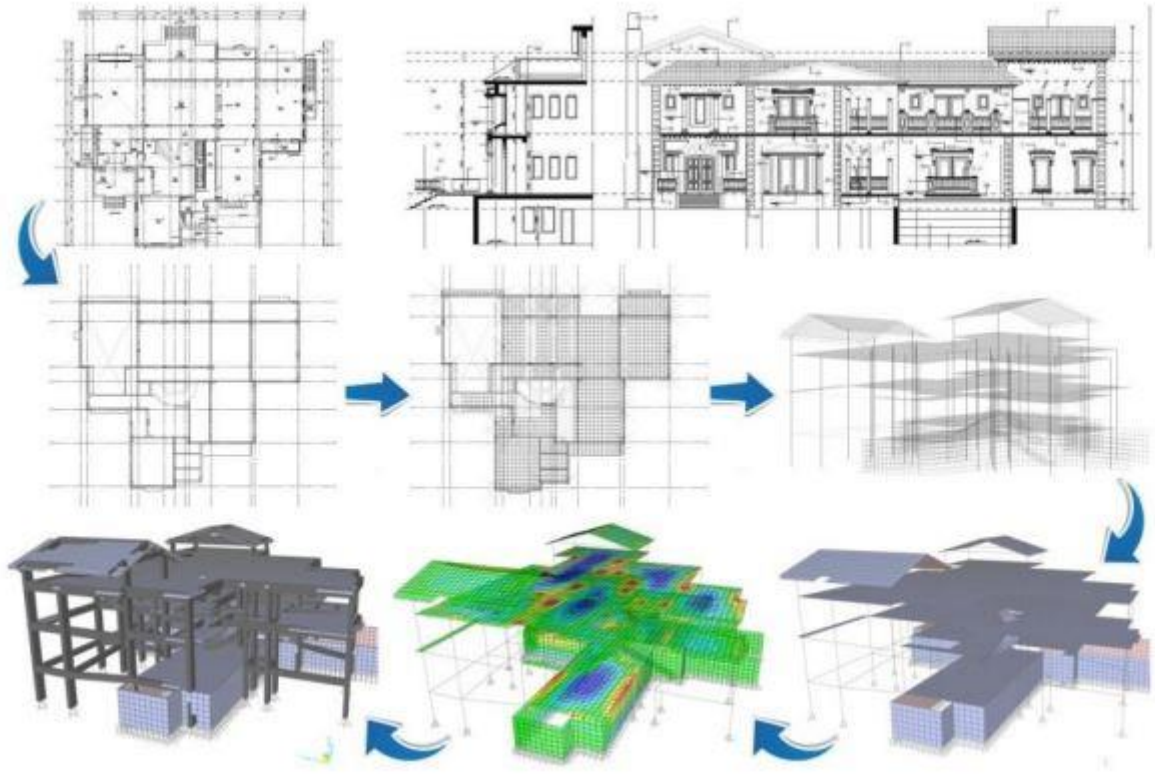

Figure 18: Structural design phases of two-story building using traditional method.

The second design methods used the newer BIM modeling including transferring between different programs checking for structural problems. Part of these steps is depicted in figure 16.

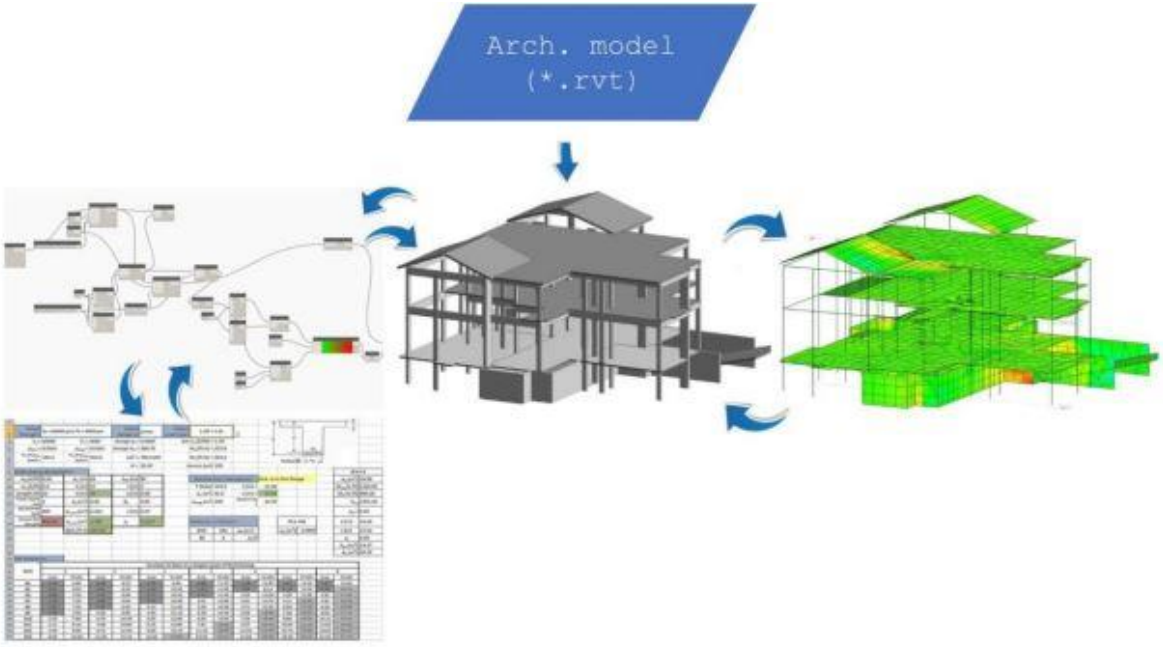

Figure 19: Structural design phases of two-story building using BIM

The study found that the ratio of time spent on the tradition method versus the newer method was a 12:1 ratio, with 92 hours spent on the traditional method's manual steps versus 8 hours on the advanced workflow. The breakdown of working hours is stated in table 5 and depicted as bar chart in diagram 17. The time needed to create the drawing and diagrams for the newer method was not taken into account as it was negligible. There may not be such a large discrepancy in all cases but comes down to the complexity and requirements of each project.

Table 4: Comparison between manual tasks working hours of the studied structural design workflows.

Manual Tasks in Structural Design	Conventional Workflow Working hours	Advanced Workflow Working hours
Design of statical system	16	6
Digitization of structural elements and meshing	16	Automated task (structural elements are pre-defined)
Insertion of loads and actions	12	2 Semi-automated task (Revit® stores building uses & auto-applies loads)
Obtaining design results from Excel sheets	8	Automated task (Revit® & Excel exchange data via Dynamo)
Drawing structural plans	40	Automated task (user selects the views/details to be automatically generated in Revit®)
Total working hours:	**92**	**8**

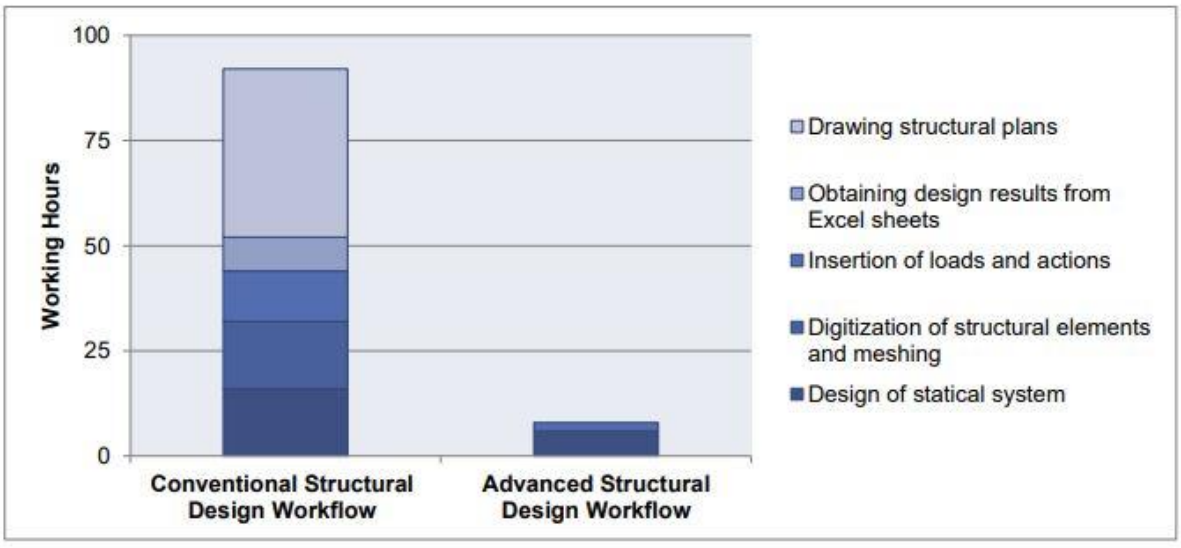

Figure 20: Comparison between manual tasks working hours of the studied structural design workflows.

4.3 What challenges can be expected?

BIM can cause massive issues in relationships of the project owners and the participants due to contracts agreements. This is due to contracts being traditionally tailored to the older CAD methods of designing. This is coupled with the greater reliance on interconnectedness and early interaction between the engineers and architects along with designers.

Challenges with Collaboration and Teaming

The increasing need for collaboration introduces newer issues into the development of teams and their effectiveness. How teams share data and work together causes significant issues. When the architect uses traditional methods it provides the necessary details to the contractor. When the architect uses BIM it may lack the sufficient details needed for the creation of the building. This may cause costly redraws. This will add time and cost to the project that may not have been there for the traditional method. But a 3D model usually justifies these possible failures of BIM, as it provides construction planning and detailed design by mechanical, plumbing, other subs and fabricators, design change resolution, procurement, and so forth. Another issue that arises if teams are using different software to render images causing potential collisions in one drawing while they do not appear in the other.

Changes in Practice and Use of Information

The use of BIM forces the integration of teams earlier into the design phase. Companies that have construction and design teams under one roof will benefit the most for BIM as they do not need to go outside their organization to cooperate. But companies that do not house inhouse design teams and construction teams will face significant issues when it comes to the greater interconnectedness as sharing models of their design back and forth can create confusion. But like most new technologies given enough time and training this will become the norm. Effect use of BIM cannot just be in the design and construction teams but must be a large facet of the company itself for it to go smoothly.

As with all technologies it is not the absolute solution BIM has uses throughout the AEC industry but adoption and training are large hurdles. However, with advancing technology and the need for sustainability along with ecological protectio

CHAPTER 5

KAVAJA MIX USE BUILDING

A study of the organization and the process of the project done in CAD and BIM tools technology. Today, BIM is perceived as software only when it should be seen as an integrated process in achieving such kind of progress with the integration of information technology, software and hardware too. There exist many typologies and ways on how project is proceeded. Some of the companies use the simpler ways by having in consideration the use of basic and traditional programs. While in the other hands with the change of the technology there are companies which have decide to be part of the use of new different tools and program in such case the use of building information technology BIM.

As mention above the aim of the study is to clarify and point out the benefits of using BIM in this case by giving an actual example of a building in Kavaja City build by Taulant Shpk Company. The project consists on a mix use building chosen to be done by using the traditional way of working or in other word by using mostly CAD program. The study itself shows the process by pointing out the most importing stages of the project done by the company by using CAD and then comparing it in the same time with the more advanced tools by using BIM.

All the given information is based on the questioners and data gathering from the company workers. Continuing with the realization of the same project in BIM (By using Revit) showing the evaluation of the process and the benefits of using it.

5.1 Description of the project

The project is located in Kavaja City. The aim of the project is the accommodation, shelters and in the same time improvement of the way of building in a safer way to the families who lost their houses from the earthquake of 26 November 2019.

The Kavaja site has been chosen as an appropriate area to be built for the community. Based on the Albanian regulation there will be public activities in the ground floor of the building, the land use coefficient will be 40 % and the proposed height for the building will be 6 floors.

5.2 Location of the site

The Kavaja site or as known area number 1. Is located near the center of Kavaja city. The gross area of the site is 34 592 m2 and according to the height of the exciting building that varies 1-2 floor is clearly seen that the density of the site according to the city is low.

The chosen height of the building is going to be done by taking into consideration:

1. The height of the existing building
2. The allowed distances
3. The sun orientation

One of the most important goals is the organization of the spaces in such a way of creating public spaces, resting area and overall greenery of the site. The decision of the plans is made based on 3 modules: 1+1,2+1,3+1 apartment. Most of the apartments has a good sun orientation and in 2 different facades in such a way to create better and more comfortable areas for the people that will live in.

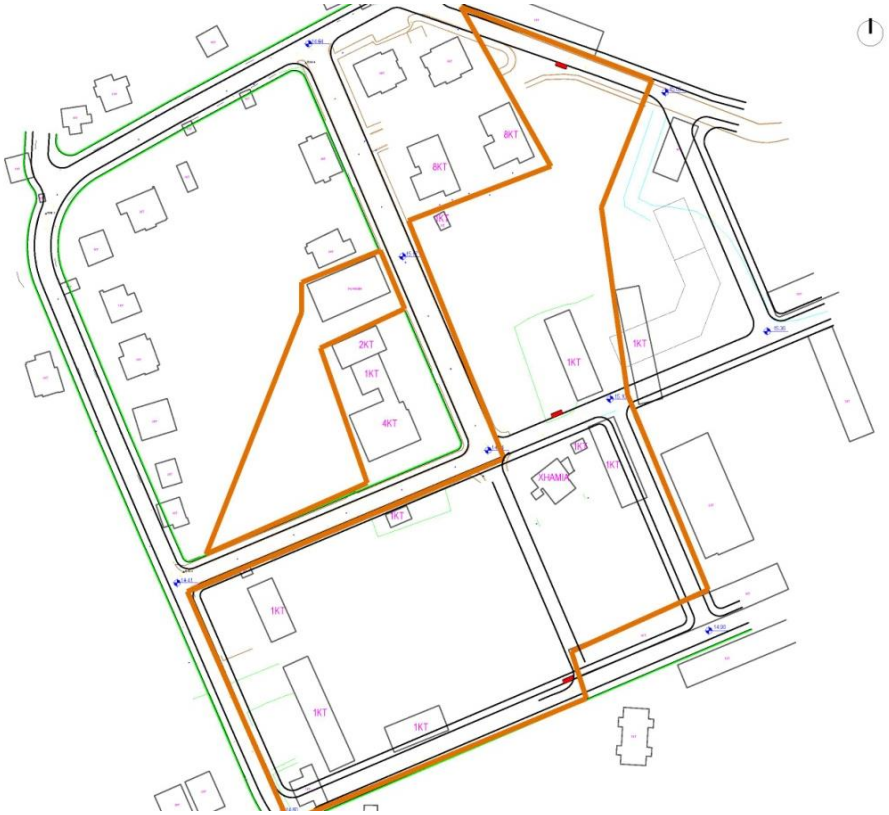

Figure 21: The existing area of Kavaja project

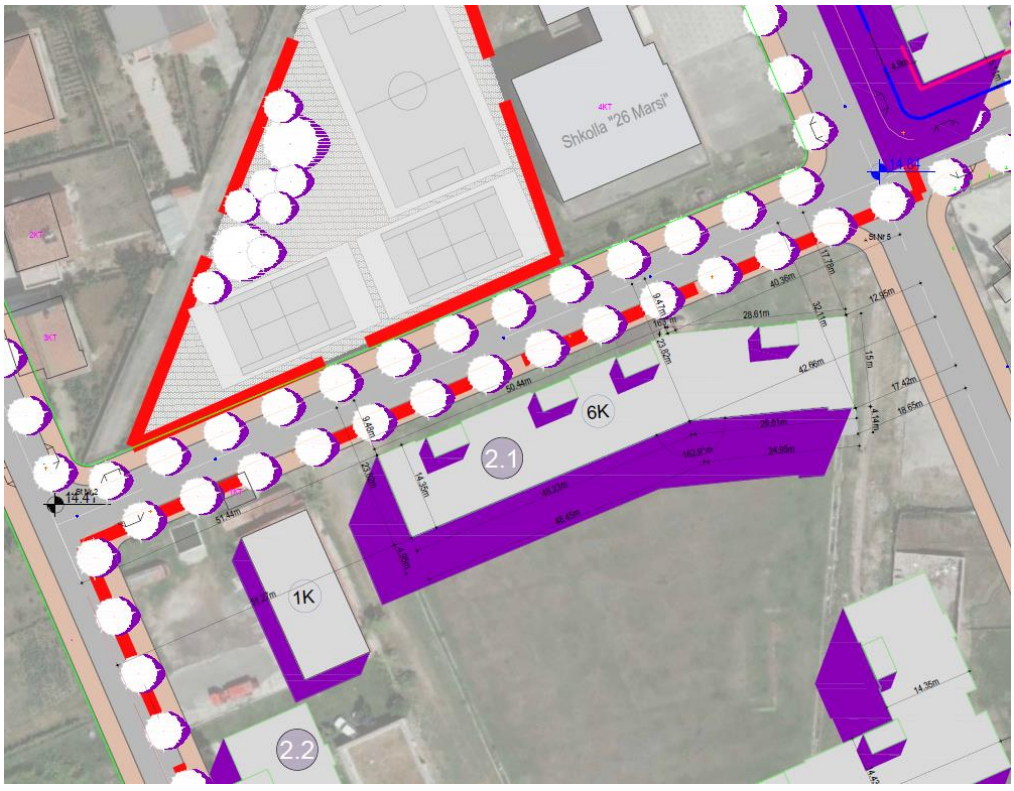

Figure 22: Building 2.1 The site plan

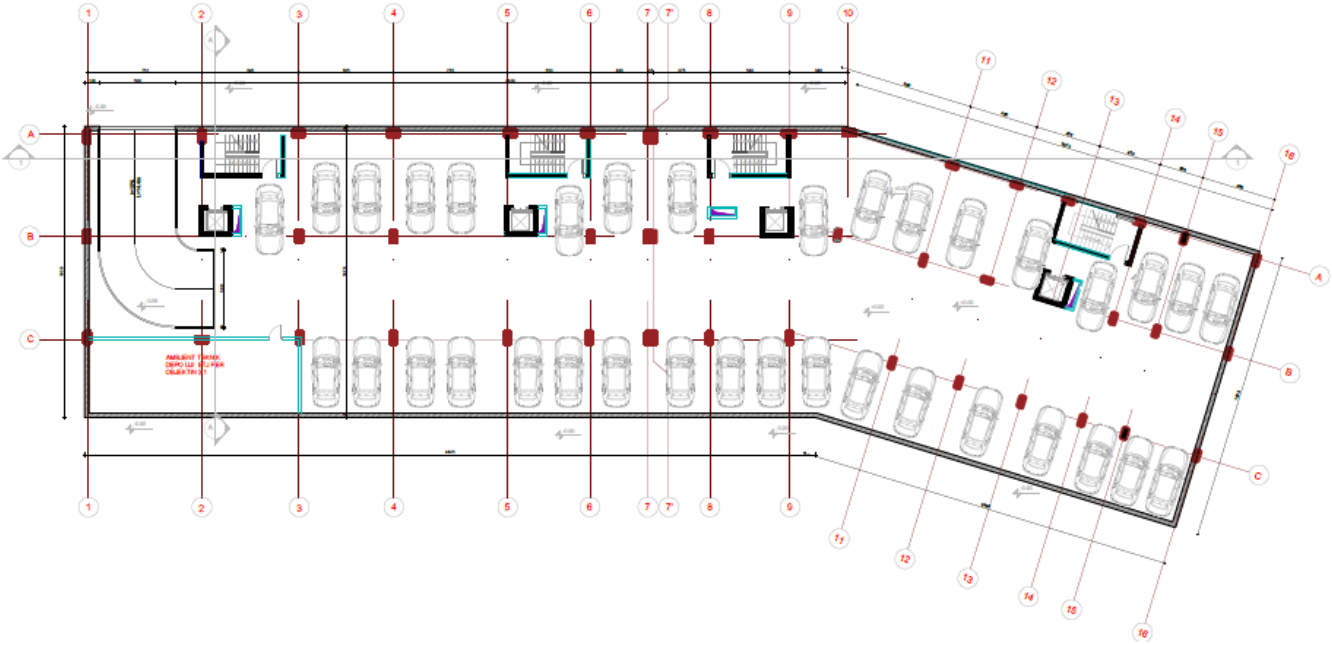

Figure 23: The parking plan

Table 5: Information about the project in Kavaja city

Objekti 2.1	Apartamente 1+1	Apartamente 2+1	Apartamente 3+1
Kati tip (Nr. i ap)	7	5	1
5 kate banim (Nr. i ap)	35	25	5
Nr. total i apartamenteve			65
Sip. e njollës			1090m^2

Sip. totale e 5 k banim			5500 m^2
Sip. e shërbimeve			1089.5m^2
Sip. totale e objektit			6590 m^2

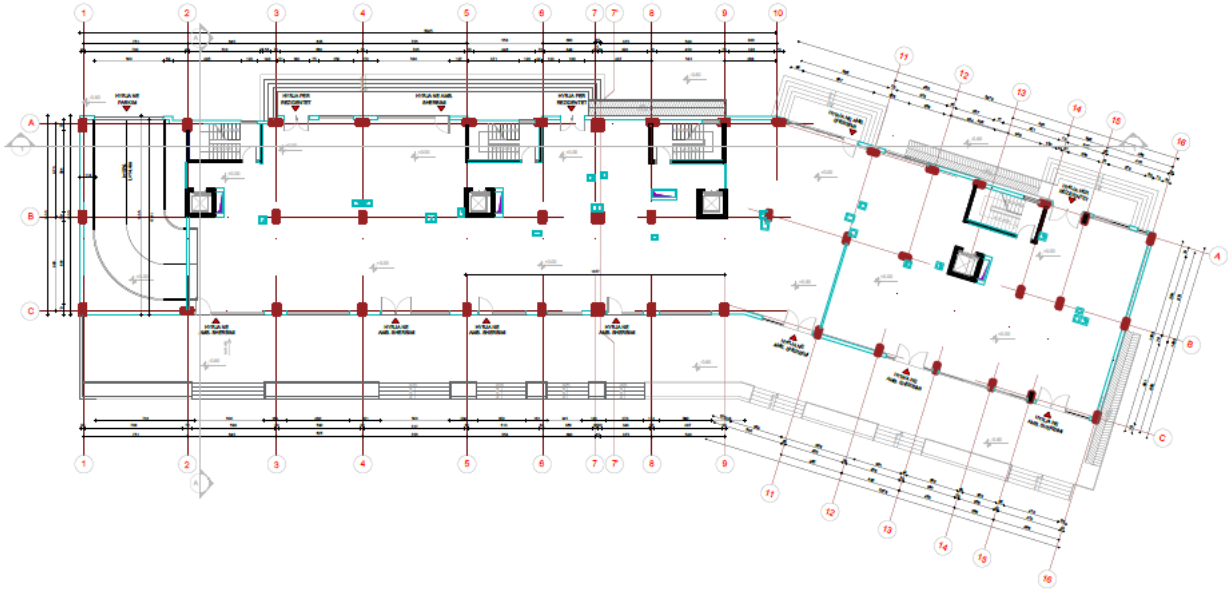

Figure 24: The ground floor plan

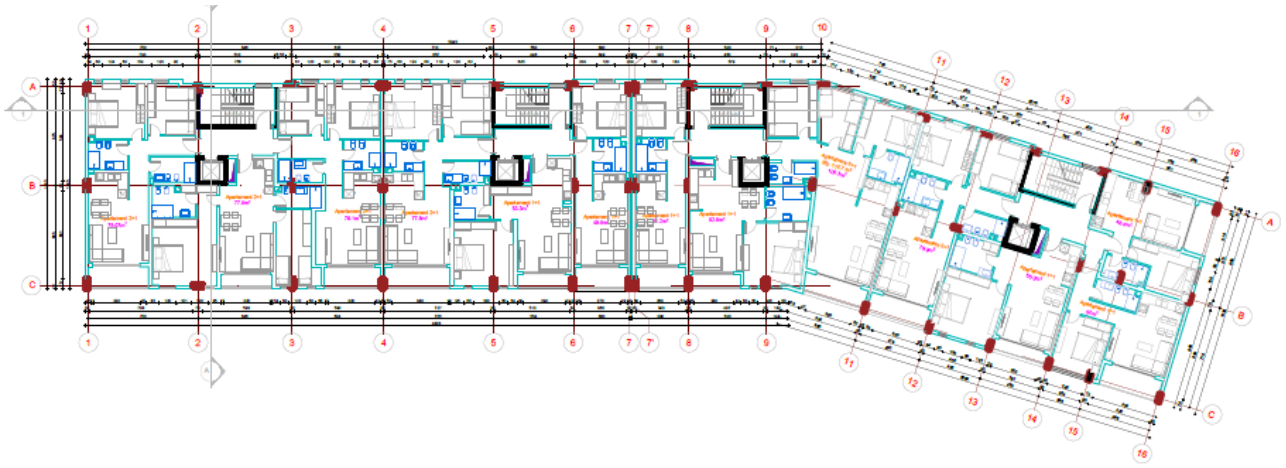

Figure22: The ground floor plan

5.3 The starting point and Architectural phase of the project

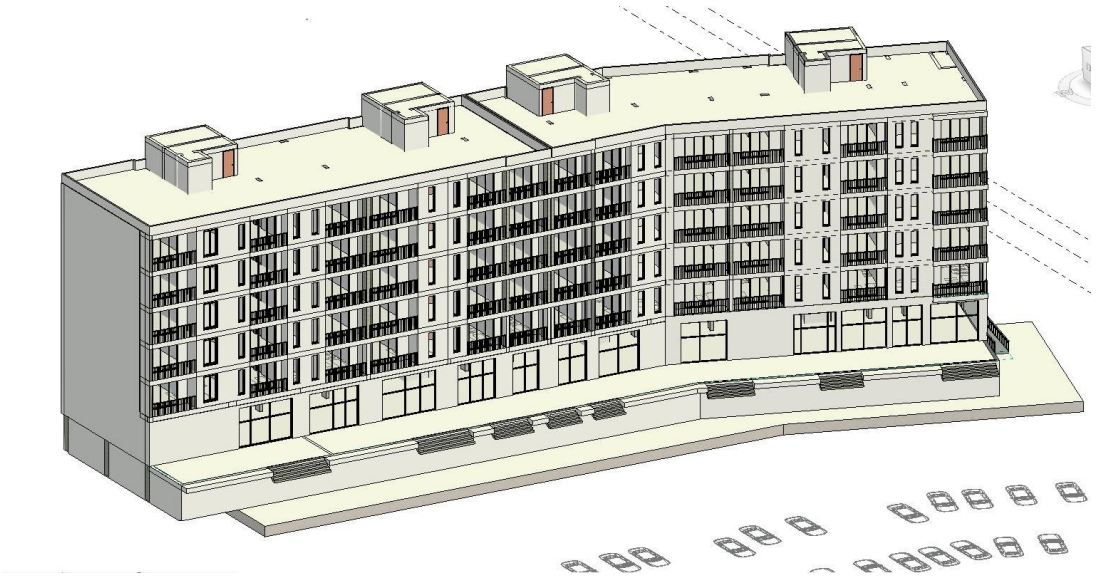

Figure 25: *The Composite Architectural model of Kavaja's*

Based on the information given from the company and its questionnaire, the building will be developed in an urban environmental. The height will be 6 floor and an underground parking. The other part of the site will be used for resting and other public activities.

The project started from the very first beginning, the conceptual phase until the 3d visualization. It consisted on the discussion between the architect and engendering about the structure the form and function of the building. The very first used programs was Cad. The company started working on the 2d drawings by using CAD. There were more than 5 architects working on the 2d views of the building and trying to give the information and the work done so far to the other part of the company.

This is one of the most needed part of working with BIM. While in the traditional way is difficult to understand and do be in the same line with the others because of not being able to control and see what the others have been working so far, with BIM u are able to check and get all the data information from the others.

The first difference of using BIM on the Kavaja's Project is starting by creating

the 3d view of the mix use building. Often 3d model of the building is wrongly considered to be BIM. It should be noticed that BIM is essentially a package of data, which may involve all information throughout the building life cycle, from design construction and management building even to the renovation and demolition of it.

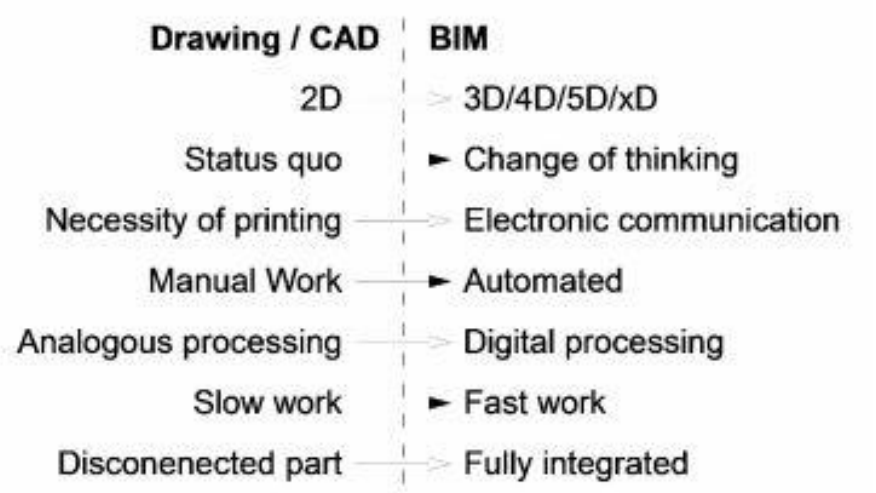

Figure 26: CAD vs BIM

Even if we are talking about the very first stage of the project changes needs to be done. In the situation where the Kavaja's project is done by using traditional workers has been dealing with difficulties in the changing process. When one of them did changes on the 2d view such as plan, these changes needs to be done in the other views such as façade or section which means another person will make the changes by costing more time and making it difficult to be understand and to be saved for the others.

ON the other time When BIM is implementing it is important to be mention that each participant in the process must contribute by the information into the database. BIM package is based on the cooperation of each process.

If the one of the elements of these processes refuse to share the information, the methods will not work. The BIM transition will place new demands on the knowledge of all participant through the cycle of building. In the situation where project is done by implementing BIM every step and changes done in one view is shown automatically in the other views by making it easier and giving the opportunity to the workers to be able to see and agree with all the changes during the whole process of the project.

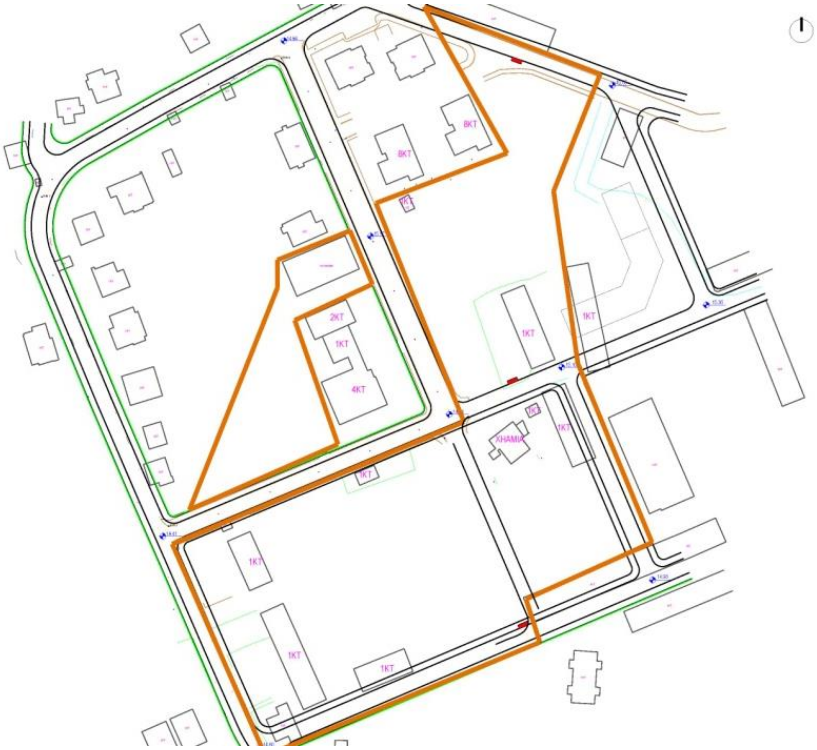

Figure 27: Starting phase in CAD vs Starting Phase in BIM

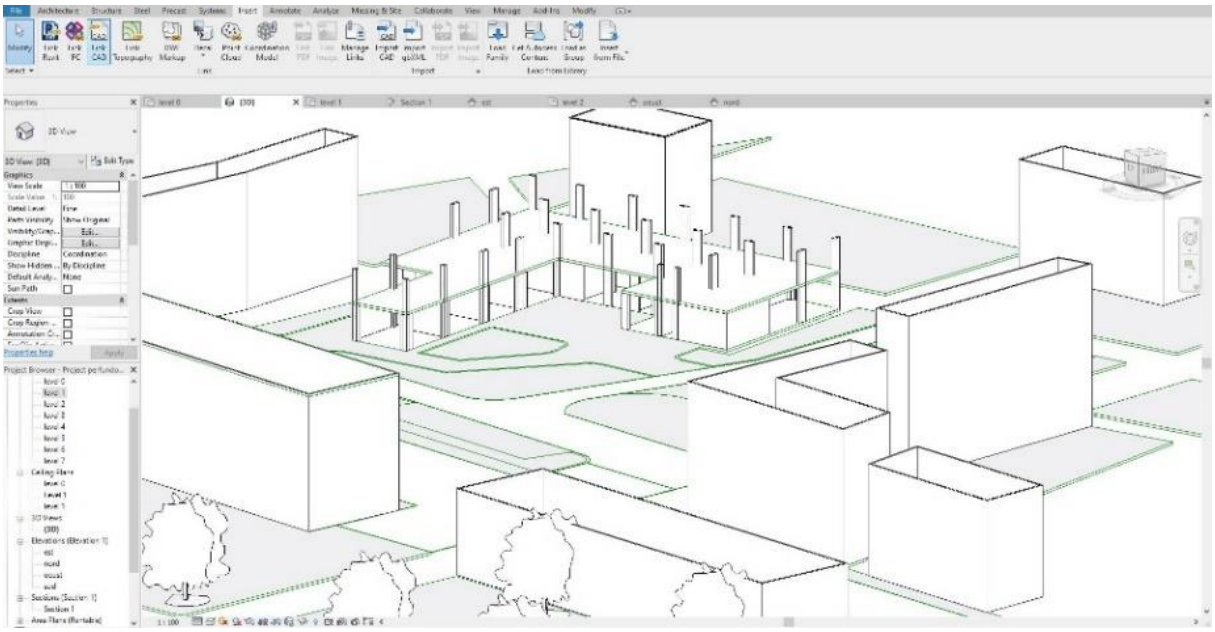

Figure 28: Starting phase in CAD vs Starting Phase in BIM

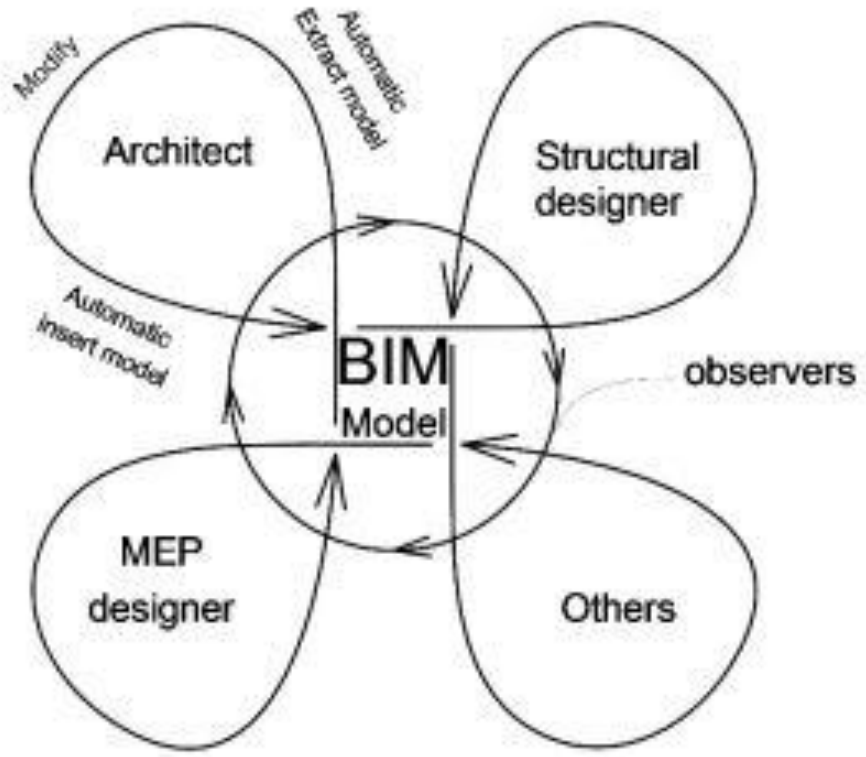

Figure 29: Optimal way to work in BIM model

All participant work with the same model in real time. Another advantage of using BIM platform explored during the working process on Kavaja's project is the time saving. The great efficiency of using a BIM software means that the designer can concentrate more on the creativity aspects of the project without having constantly worry about updating multiply entities throughout the entire process.

It follows an incredible increase in productivity because each object chosen from a BIM object menu already comes with a set of pre-defined information that can provide useful data for calculating project cost., thermal performance aspects, maintenance, structural etc.

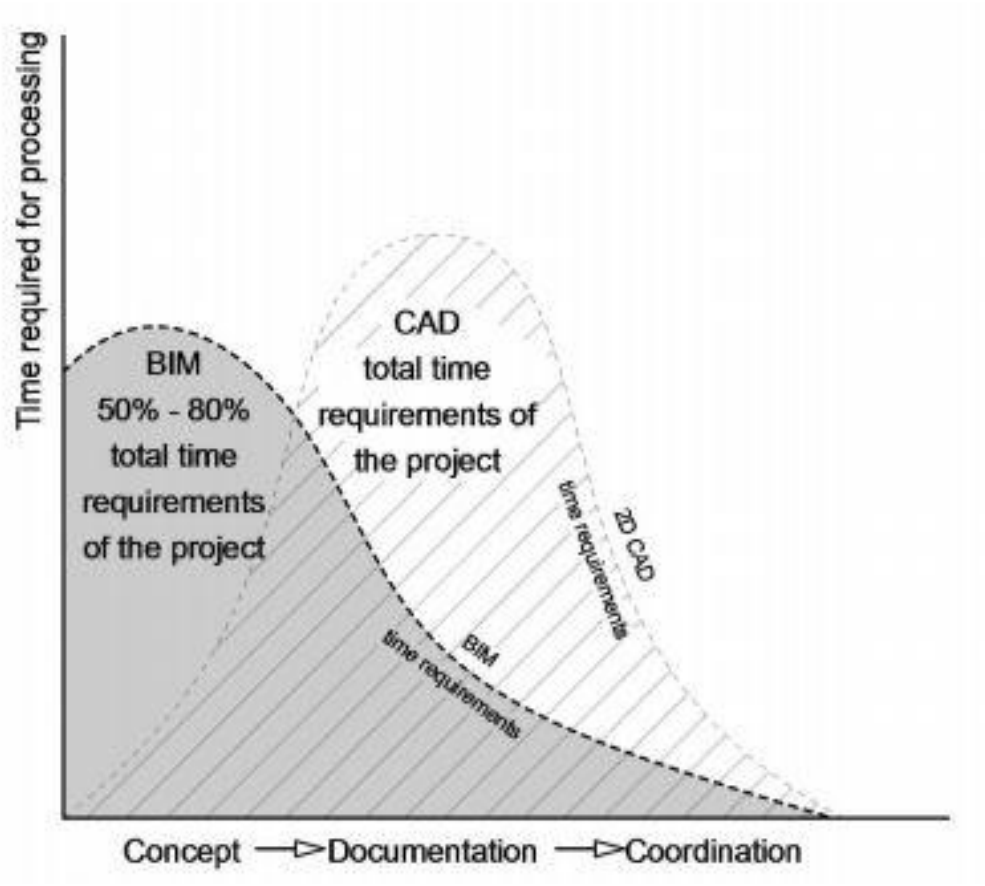

Figure 30: The data gathering according to the time saving

All this leads to a considerable saving of time. After the calculation of the process it leads to the conclusion that it took 2-3 month to the company to almost finish with all the information gathering from the process of the project. In the other side by using the platform BIM it took only 60-80 hours to have a finish data gathering and information from 2d view to 3d model and other facilities.

The process was done during the construction phase by using Revit and then NavisWork which allowed on realizing clash detection. Below, it is better shown how the process was done so far and how it stands according to the traditional way, using CAD.

5.4 The starting point and Structural phase of the project

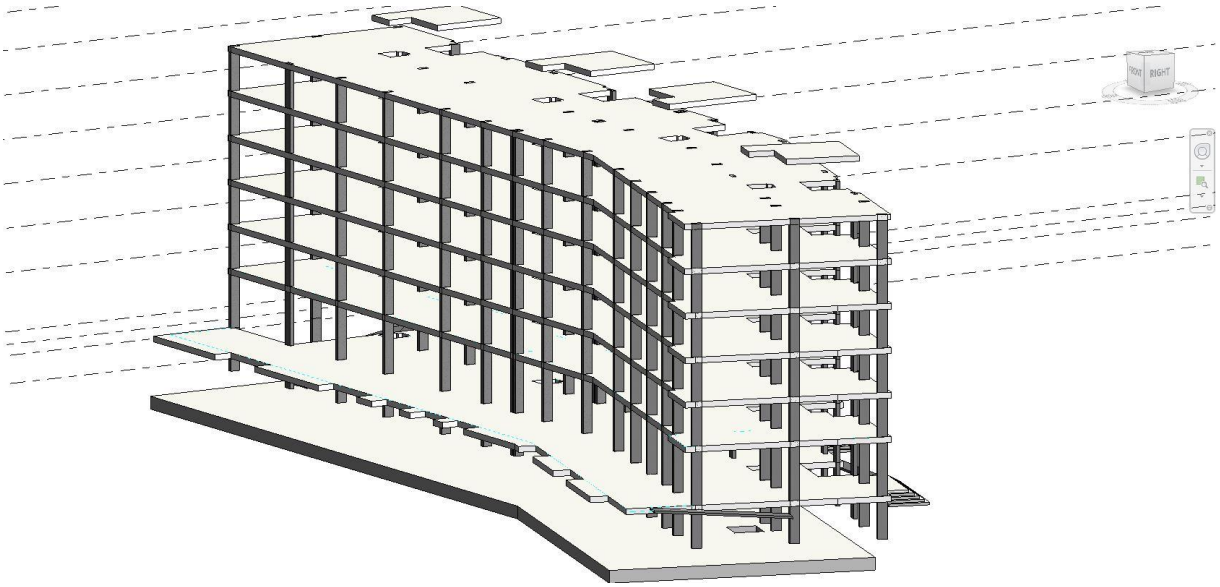

Figure 31: *The Structural model of Kavaja's project*

All mention above was a general calculation about the project. It needs to be mention that there was a very good benefit on using BIM even during the construction model phase.The process was done during the construction phase by using Revit and then NavisWork which allowed on realizing clash detection.

Below, it is better shown how the process was done so far and how it stands according to the traditional way, using CAD.

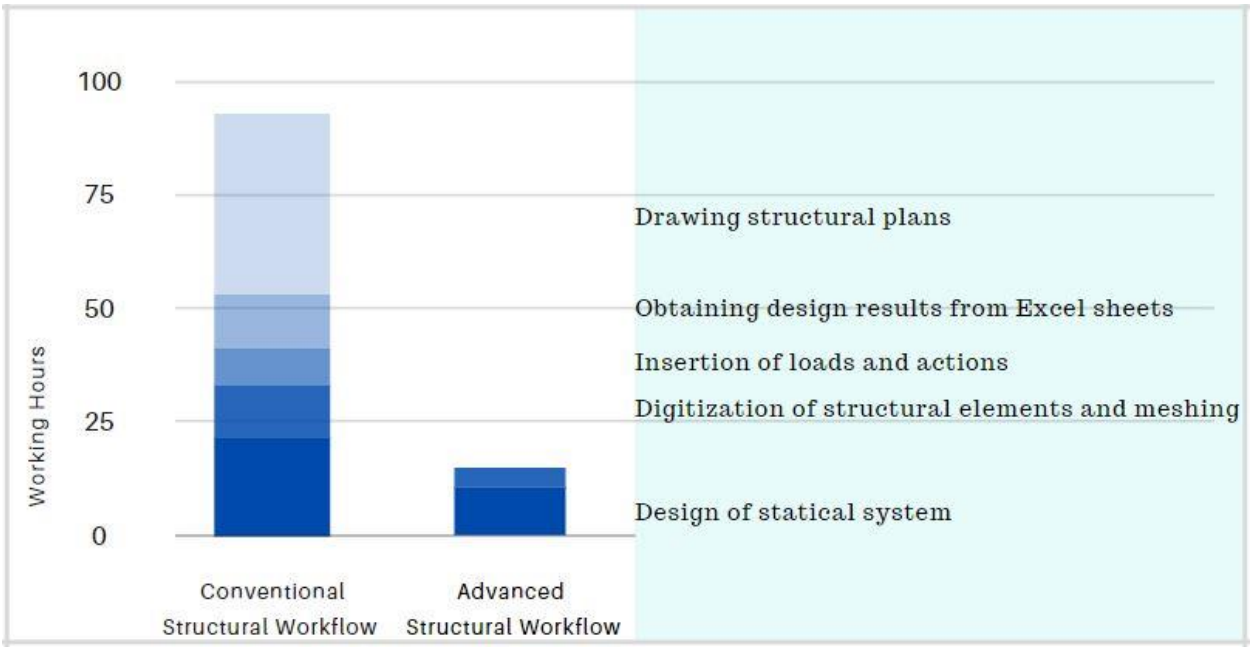

Figure 32: CAD vs BIM Structural Workflow of Kavaja's Project

Based on the questionnaire done to the group of workers of the project, it was very difficult the management of the amount of time during the structural phase of the project. As far as the company used Cad and other traditional ways of doing the project, there need to be a good organization of the work done by each person.

The figure 23 shows better how the process of the project stands according to the traditional way and by using BIM. The figure shows some calculation done about the drawings structural plans, structural elements and statical system and how these elements stand according to the time. Based on it, it is quite understandable that the amount of time used with the traditional way is much more then the time used during the BIM implementation methods.

There is almost 25-30 hours that have been used to complete and fulfill the requirements of the project by using BIM the advanced program. From the other side, there is CAD which has a spread of the time all over the process by spending almost 75 – 80 hours.

Manual Tasks in Structural Design	Conventional Workflow	Advanced Workflow
Design of statical system	20	10
Digitization of structural elements and meshing	20	Automated Task
Insertion of loads and actions	15	4 Semi-Automated Task Revit
Obtaining design results from Excel	5	Automated Task Revit
Drawing structural plans	40	Automated Task (Users select the views/details to be automatically generated in Revit)
Total working hours	100	14

Figure 32: Design process CAD vs BIM

The whole process of organization of the thesis and pointing out the difference between using Cad or other traditional ways and to the newest ways as BIM application is id not done as a comparison to show which one is better than other rather to clarify and let all the companies and people who works in this field to know the reason why they should adapt this kind of programs ,the benefits of using it and all the other data information needed to understand in order to a better and simpler way of doing the project.

One of the really good benefits of using BIM is the possibility of this program that allows the workers to control design in the very first beginning of the stage before the construction of it by using other programs such as Navis Work that includes clash detection process.

It needs to be mentioned the fact that the company did the project in CAD and they did not have the chances to go through the detection and other problems before the construction phase. In the other hand, by using BIM what I can actually tell and what's the most important let the other knows is that it was a whole easier process to understand the way how the building would turn out and how the whole process of it is going to be continued.

The programs allowed to catch any detection or problems on the project by giving you the chance to go back and fix them all before the start of the construction phase of the project.

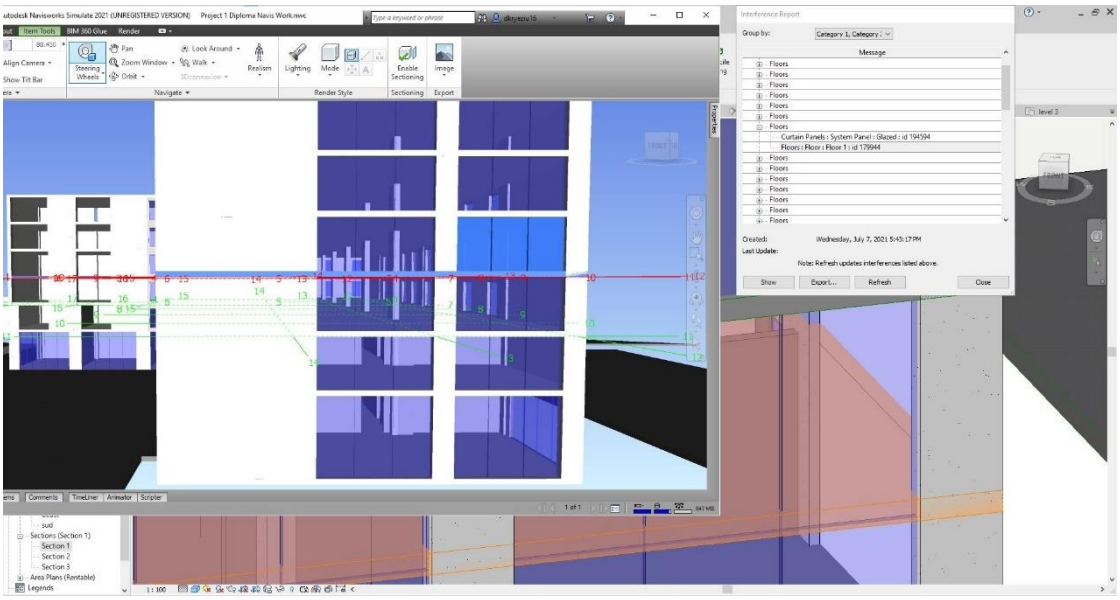

Figure 33: Screenshot of the project in Navisworks /Clash Detection

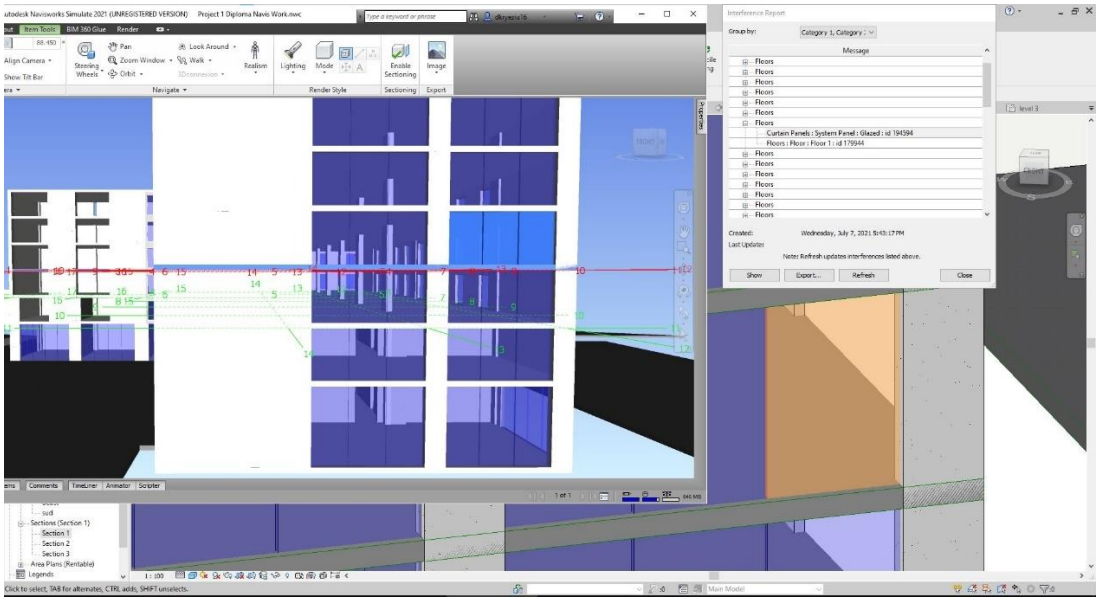

Figure 34: Screenshot of the project in NavisWork /Clash Detection

The purpose of utilizing Navisworks software is to detect clashes and check interference among model elements by testing across the whole composite model or by checking particular subsets of the model elements. This BIM tool allows the user to set the rules, recognize clashes, Produce Reports, Trace Clashes, Status Clashes, Manage Clashes, Custom Clash tests, Clearance Tests, time-based clashes. Therefore, Navisworks manages work through streamlined workflow across the organization and teams, promoting to reduce waste, raise efficiency, and eliminate change orders. In Navisworks, skill in navigating the model, aggregating clashes, and searching the model are essential to running a practical coordination project, and Navisworks gives powerful tools to succeed in these tasks. After the creation of 3D models (Architectural, Structural, and MEP) by Auto Desk Revit.

It is necessary to import the 3D model into Navisworks Manage in order to clash detection. In the next step, all native Revit format (Revit files) should be converted into Navisworks file format by file exporter (available in Autodesk Revit 2018).

Figure 35: Render 1 of the building done in BIM/ Revit

Figure 36: Render 2 of the building done in BIM/ Revit

Figure 37: Render 3 of the building done in BIM/ Revit

As being mention above when the comparison of the project is done, there is many reason and benefits of using BIM. It is not only a tool but a whole process of evaluation and cooperation not only with the other programs but in itself too.

Time pas buy the ways of how companies work is changing and so AEC industries is to and with the increased need for BIM adaption the AEC firms needed a system through which they can analyses all the benefits of BIM application mention above. As soon as firms and companies even the workers are aware of BIM adaption the changes during the time its way of application and the need of the benefits of BIM allocation there will be always easier and better ways for achieving such a greater product in different project.

5.5 Future of BIM

The future of BIM is certainly exciting. Most Architectural firms are either already using BIM or are playing the catch-up game. Contractors are realizing that BIM is essential. Some contractors get BIM models done for the 2D construction document set they receive in tenders. They then utilize the BIM model for validating,

planning and executing their scope in a more efficient manner and avoid rework due to errors in tender documentation. Clients have started instructing their contracts department to ensure that their next project work order mandates design delivery through BIM. Some governments have started mandating BIM for construction projects in their country.

The overall impact of BIM for all the stakeholders of any construction project is immensely positive. To name a few - Architects can validate and develop their design ideas in a digital environment before actual construction. They can produce better error free drawings and documentation. Cost estimation can be done more accurately. Project managers can better visualize, plan and execute the design more effectively by using BIM. All these factors enable the project design and construction team to pass on the benefits of better design, time and cost to the client.

CHAPTER 6

CONCLUSION

6.1 Conclusion

The purpose of the thesis and project was to better understand the time changing ways of the progress of a project and being able to adapt with the new technology.

As already know the people are always in search of different and new innovative ideas or ways for a better and easier process of doing the project. Companies are always searching good and fast ways of the process project. It is difficult in the same time to use the new technology. In some cases, it does not lead to a good direction, because of the difficulty of the workers in adaption of the new programs. In the other cases it leads to a new good area of construction and architectural projects.

The world we live in is always changing and we hope for good. It is always easier to do works or other commitment as soon as we discover new ways of achieving the progress of the project.

This thesis presents the organization and the way of how BIM the new technology works and adepts in the different project. It shows clearly the benefits of using it and the understanding of the companies working with it. It is not an easy process to do so. Beside the benefits there are disadvantages of using BIM but as it should be known all the programs have their good and bed parts of it. The idea of using the program is to only take advantages of the new technology, to adapt and lead to a good final product only.

There will always be new technology and what we have to do is to understand and use the technology in the good of the workers companies and final project product.

The thesis main objective was to design a community center that actually work. In order to achieve that it was important to do a careful examination of the existing context.

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APPENDIX

Questionnaire

The reason of doing the questionnaire is to get enough information about the process and its process by using CAD the traditional way. But, in the same time to know more about the experience that the group team had, their way of work and their challenges during the process of Kavaja's project.

1. How is the organization of the group workers in your company?
2. How many workers from the company took place in the organization and realization of Kavaj's project?
3. What computer programs were used for the development of the project?
4. What is the duration required for the competition of the project?
5. 5.What are the challenges during the project process?
6. 6.How was the collaboration of the workers during their timework?
7. 7.As far as computer programs are involved, what was the most difficult task to fulfill?
8. 8.What is the duration required for the competition of project? (Approximately)
9. Which are some of other requirement or documentation that you may share?

All the information taken from the questioner above are taken in consideration and included in the thesis and, its aim and conclusion of it.